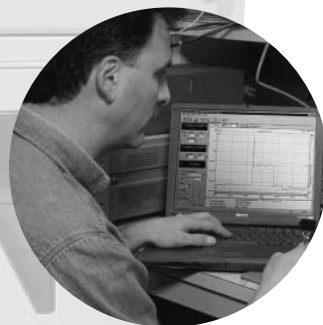


# System and Bench Instruments Catalog 2005



## Detailed Specifications, Application Briefs and more for:

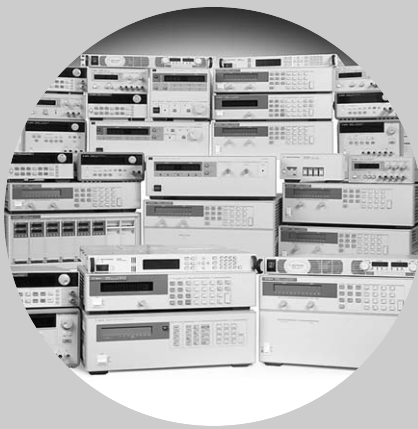
- DC Power Supplies
- DC Electronic Loads
- AC Power Solutions
- Digital Multimeters/Voltmeters
- Function/Arbitrary Waveform Generators
- Data Acquisition and Switching
- Frequency Counters



**Agilent Technologies**

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Data Acquisition and Switching Systems**



One quick browse through this catalog will convince you that Agilent products offer so much more than simple power generation, or measurement, or signal switching. In each product category, we've integrated the capabilities you need for a complete solution. Our one-box approach improves test results while cutting costs, complexity and rack size.

This catalog contains detailed technical and application information on digital multimeters, DC power supplies, arbitrary waveform generators, and many more instruments. With over 180 products to choose from, it includes easy to use selection guides for each product category to help you select the best product for your application. Also highlighted are our most recent product introductions like the new N6700 Low-Profile Modular Power System and the new 34980 Switch/Measure Solution.

For the most comprehensive product information, we've provided a unique URL to each product's website where you can find data sheets and application notes, download drivers, and view videos and interactive demos.

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We've been a leader in the power and measurement business for more than four decades because engineers like you know they can count on Agilent performance and reliability. We specify and guarantee performance for the entire integrated system, so you know what you're really dealing with—unlike the typical “rack-and-stack” setup. Plus, every Agilent product in this catalog has a global warranty.

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# Table of Contents

<b>New Products, Agilent Open</b>	3-4
<b>DC Power Supply Selection Index</b>	5-11
<b>DC Power Supply Feature Description Index</b>	12-15

<b>Basic DC Power Supplies...essential features for a tight budget</b>	<b>16</b>
Single-Output: 30-60 W	17-18
Multiple-Output: 35 and 50 W	19
Triple-Output: 80 W GPIB	20
Single-Output: 120-200 W GPIB	21-22
Single & Dual Output: 30-100 W GPIB	23-24
Autoranging: 200-1000 W	25-26
Autoranging: 200-1000 W GPIB	27-29
Single Output: 750 W & 1500 W GPIB, LAN, USB	30-34

<b>High Performance DC Power Supplies...speed and accuracy for test optimization</b>	<b>35</b>
Single-Output: 40-500 W GPIB	36-49
Single-Output: 200-500 W	43-53
Single-Output: 2000-6600 W GPIB	54-68
Single-Output: 2000 W	61-64
Single-Output: 5000 W GPIB	65-66
Single-Output: 6600 W GPIB	67-68
Multiple-Output: 40-105 W GPIB	69-70
Precision Multiple-Output: 25-50 W GPIB	71-72
Low-Profile Modular Power System: 50-100 W GPIB, LAN, USB	73-78
Modular Power System: 1200 W per Mainframe GPIB	79-82

<b>Application Specific DC Power Supplies...tailored solutions for specific needs</b>	<b>83</b>
Mobile Communications DC Sources	84-90
Solar Array Simulators	91-93
Component Test DC Source	94-96

<b>DC Electronic Loads...maximize throughput with real life loading conditions</b>	<b>97</b>
Multiple-Input Electronic Loads	98-104
Single-Input Electronic Loads	105-108

<b>AC Power Source/Analyzers...an integrated AC power solution</b>	<b>109</b>
AC Power Source/Analyzers: 375-1750 VA	110-117
<b>Power Products AC Line Voltage and Cord Options</b>	118-123
<b>Power Products Applications Information</b>	124
Top 10 FAQs	124-127
AC Power and Load Connections	128-135
Power Product Terms	136-141

More detailed specifications at [www.agilent.com/find/power](http://www.agilent.com/find/power)

# Table of Contents

(Continued)

<b>Data Acquisition and Switching</b>	<b>142</b>
34970A Low-Cost Data Acquisition/Switch Unit	143-148
34980A Multifunction Switch/Measure Mainframe and Modules	149-156
<b>Digital Multimeters, Voltmeters</b>	<b>157</b>
34401A Digital Multimeter, 6½ digits	158-161
3458A Digit Multimeter, 8½ digits	162-164
34420A Nanovolt/Micro-ohm Meter	165-167
<b>Frequency Counters</b>	<b>168</b>
53131A Frequency Counter, Two Ch, 10, digit/s	169-171
53132A Frequency Counter, Two Ch, 12, digit/s	169-171
53181A Frequency Counter, Single Ch, 10, digit/s	169-171
53140 Series Microwave Frequency Counter with Power Meter	172-174
53150 Series Microwave Frequency Counter	175-177
<b>Function/Arbitrary Waveform Generators</b>	<b>178</b>
33220A Function/Arbitrary Waveform Generator, 20 MHz	179-181
33250A Function/Arbitrary Waveform Generator, 80 MHz	182-184
<b>VXI Instruments, 3499 Switch Solutions and Connectivity Products</b>	<b>185</b>
<b>Model Number Index</b>	<b>186-187</b>
<b>Replacement Guide</b>	<b>188</b>

# New

# More Products from Agilent



## **34980A Multifunction Switch/Measure Mainframe and Modules**

Mix and match your switching with this compact and economical 34980A Multifunction Switch/Measure Unit for medium to high-density switch/measure applications. The 34980A is an 8-slot modular mainframe with 19 plug-in modules in switching, digital I/O, D/A converter, counter/totalizer functionality and comes with open connectivity. **See Page 149**



## **N5700 Series System DC Power Supplies**

Get just the right performance at just the right price— in a compact (1 U) package. These affordable 750 W and 1500 W single output programmable DC power supplies with open connectivity simplify system development and are ideal for simple DC power applications. **See Page 30**



## **N6700 Low-Profile Modular Power System**

The N6700 Modular Power System is small, flexible and fast. Mix-and-match DC power modules optimize price and performance to fit your needs and budget. With open connectivity, fast command processing time, and four outputs in 1 U, the N6700 is ideal for ATE and production test systems. **See Page 73**

## **Modification Service**

While the products in this catalog are intended to satisfy a wide range of customer applications, Agilent recognizes that these products may not match all needs. To better meet your specific requirements, Agilent offers a special modification service. This service entails the design and manufacture of modified versions of standard catalog models.



## Tools to Make Your Test Development Process as Easy as it is Successful

Agilent Open products are the ones you use most, and the ones you count on for ongoing reliable results. Agilent Open products have:

### **System-ready convenience**

Selecting an Agilent instrument for your test is an easy choice because it makes system setup so easy for you. Because our IO Libraries Suite software is included with every Agilent Open instrument, you'll get an error free connection to your instruments every time. How? Agilent's connection Expert installs automatically, configuring interfaces, discovering other instruments (regardless of the manufacturer), and verifying their connections. In less than 15 minutes (yes, minutes)- and with just one reboot- your PC can be up, running, and communicating with your instruments.



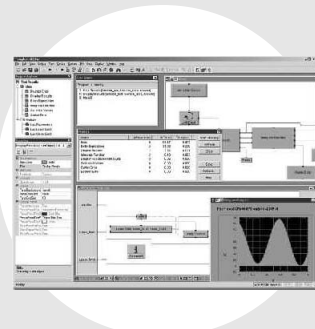
### **Standard PC I/O interfaces**

It's hard to connect instruments to your system when they don't have the right interface. Agilent minimizes the frustrations of mixed I/O interfaces by offering GPIB, LAN and USB ports in Agilent Open instruments. This gives you the flexibility to choose the interface that works best with your system now- and use another one in the future. No other test and measurement vendor supports more standard PC interfaces.



### **The flexibility to program in any software environment.**

Chances are, you're an engineer, not a programmer. So why spend time struggling with unfamiliar programming languages just to set up a test? Agilent Open means you can work in the development environment you're already comfortable with- whatever that environment might be. The IO Libraries Suite connectivity software easily transitions you to Excel or popular programming languages such as Visual Basic, C, LabVIEW, Agilent VEE Pro, Visual Basic.NET, Visual C++, Visual C# and others. So you can focus your efforts on the results from your device, not the code that gets you there.



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# DC Power Supply Selection Index

	Maximum Volts	Maximum Amps	Maximum Watts	Number of Outputs	GPB	Model Number	Type	Page Number
	3	300	900	1	*	6671A-J08	Performance	55
	3.3	1000	3300	1	*	6680A-J04	Performance	65
	5	10	50	up to 4	*	N6731B	Basic	75
	5	20	100	up to 4	*	N6741B	Basic	77
	5	875	4400	1	*	6680A	Performance	65
	5.7	20	100	up to 8	*	66101A-J03	Performance	80
	6	2.5	15	3		E3630A	Basic	19
	6	5	30	3	*	E3631A	Basic	20
	6	60	360	1		6551A-J03	Performance	51
	6	60	360	1		6651A-J03	Performance	47
	6	100	600	1	*	N5741A	Basic	31
	6	180	1080	1	*	N5761A	Basic	33
	6.7	30	200	1	*	6033A	Autoranging	27
	7	0.015	0.11	2	*	6625A	Performance	71
	7	0.015	0.11	4	*	6626A	Performance	71
	7	5	35	3	*	6623A	Performance	69
	7	5	35	4	*	6624A	Performance	69
	7	10	70	2	*	6621A	Performance	69
	7	10	70	3	*	6623A	Performance	69
	7	120	840	1		6011A	Autoranging	25
	7	120	1000	1	*	6031A	Autoranging	27
	8	3	24	1	*	E3640A	Basic	23
	8	3	24	2	*	E3646A	Basic	24
	8	3	30	1		E3610A	Basic	17
	8	5	40	1	*	6611C	Performance	36
	8	5	40	1	*	E3642A	Basic	23
	8	5	40	2	*	E3648A	Basic	24
	8	6	48	1		E3614A	Basic	17
	8	6.25	50	up to 4	*	N6732B	Basic	75
	8	8	80	1	*	E3644A	Basic	23
	8	10	80	1	*	6631B	Performance	38
	8	12.5	100	up to 4	*	N6742B	Basic	77

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## DC Power Supply Selection Index (Continued)

	Maximum Volts	Maximum Amps	Maximum Watts	Number of Outputs	GPIB	Model Number	Type	Page Number
	8	16	128	up to 8	*	66101A	Performance	79
	8	20	160	1		6541A	Performance	43
	8	20	160	1	*	6641A	Performance	40
	8	20	160	1	*	E3633A	Basic	21
	8	50	400	1		6551A	Performance	50
	8	50	400	1	*	6651A	Performance	46
	8	90	720	1	*	N5742A	Basic	31
	8	165	1320	1	*	N5762A	Basic	33
	8	220	1760	1		6571A	Performance	61
	8	220	1760	1	*	6671A	Performance	54
	8	580	4600	1	*	6681A	Performance	65
	10	5	50	1	*	6611C-J05	Performance	36
	10	50	500	1		6551A-J01	Performance	51
	10	50	500	1	*	6651A-J01	Performance	46
	10	200	2000	1		6571A-J04	Performance	62
	10	200	2000	1	*	6671A-J04	Performance	55
	+/-10.25	+/-0.5125	5.5	4	*	N3280A	Component Test	94
	12	1.5	18	2	*	66309B	Mobile Communications	84
	12	1.5	18	2	*	66309D	Mobile Communications	84
	12	1.5	18	2	*	66319B	Mobile Communications	84
	12	1.5	18	2	*	66319D	Mobile Communications	84
	12	12	150	up to 8	*	66101A-J05	Performance	80
	12.5	60	750	1	*	N5743A	Basic	31
	12.5	120	1500	1	*	N5763A	Basic	33
	13	15.3	200	1		6541A-J04	Performance	44
	14	150	2000	1		6571A-J03	Performance	61
	14	150	2000	1	*	6671A-J03	Performance	55
	15	2	30	1		E3610A	Basic	17
	15	3	45	2	*	66309B	Mobile Communications	84
	15	3	45	2	*	66309D	Mobile Communications	84
	15	3	45	1	*	66311B	Mobile Communications	84
	15	3	45	1	*	66311D	Mobile Communications	84
	15	3	45	2	*	66319B	Mobile Communications	84
	15	3	45	2	*	66319D	Mobile Communications	84

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## DC Power Supply Selection Index (Continued)

	Maximum Volts	Maximum Amps	Maximum Watts	Number of Outputs	GPIB	Model Number	Type	Page Number
	15	3	45	2	*	66321B	Mobile Communications	84
	15	3	45	2	*	66321D	Mobile Communications	84
	15	7	105	1	*	E3632A	Basic	21
	15	10	150	up to 8	*	66102A-J05	Performance	80
	15	120	1800	1		6571A-J17	Performance	62
	15	120	1800	1	*	6671A-J17	Performance	55
	15	440	6600	1	*	6690A	Performance	67
	16	0.2	3.2	2	*	6625A	Performance	71
	16	0.2	3.2	4	*	6626A	Performance	71
	16	0.2	3.2	2	*	6628A	Performance	71
	16	0.2	3.2	4	*	6629A	Performance	71
	17	30	510	1	*	6651A-J09	Performance	47
	20	0.5	10	3		E3630A	Basic	19
	20	1.5	30	1		E3611A	Basic	17
	20	1.5	30	1	*	E3640A	Basic	23
	20	1.5	30	2	*	E3646A	Basic	24
	20	2	40	1	*	6612C	Performance	36
	20	2	40	3	*	6623A	Performance	69
	20	2	40	4	*	6624A	Performance	69
	20	2	40	4	*	6627A	Performance	69
	20	2.5	50	1	*	E3642A	Basic	23
	20	2.5	50	2	*	E3648A	Basic	24
	20	2.5	50	up to 4	*	N6733B	Basic	75
	20	3	60	1		E3615A	Basic	18
	20	4	80	2	*	6621A	Performance	69
	20	4	80	2	*	6622A	Performance	69
	20	4	80	3	*	6623A	Performance	69
	20	4	80	1	*	E3644A	Basic	23
	20	5	100	1	*	6632B	Performance	38
	20	5	100	1	*	66332A	Mobile Communications	84
	20	5	100	up to 4	*	N6743B	Basic	77
	20	7.5	150	up to 8	*	66102A	Performance	79
	20	10	200	1	*	6033A	Autoranging	27
	20	10	200	1	*	6038A	Autoranging	27
	20	10	200	1		6542A	Performance	43
	20	10	200	1	*	6642A	Performance	40
	20	10	200	1	*	E3633A	Basic	21
	20	15	300	1	*	6651A-J09	Performance	47
	20	25	500	1		6552A	Performance	50
	20	25	500	1	*	6652A	Performance	46

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## DC Power Supply Selection Index (Continued)

Maximum Volts	Maximum Amps	Maximum Watts	Number of Outputs	GPIO	Model Number	Type	Page Number
20	38	760	1	*	N5744A	Basic	31
20	50	1000	1		6011A	Autoranging	25
20	50	1000	1		6012B	Autoranging	25
20	50	1000	1	*	6031A	Autoranging	27
20	50	1000	1	*	6032A	Autoranging	27
20	76	1520	1	*	N5764A	Basic	33
20	100	2000	1		6572A	Performance	61
20	100	2000	1	*	6672A	Performance	54
21	240	5000	1	*	6682A	Performance	65
24	6	100	up to 8	*	66103A-J12	Performance	81
24	85	2000	1	*	6672A-J04	Performance	55
25	1	25	2		E3620A	Basic	19
25	1	25	3	*	E3631A	Basic	20
25	7	160	1	*	E3634A	Basic	21
25	7	175	1	*	E3634A	Basic	21
27	20	540	1	*	6652A-J03	Performance	47
28	5	140	up to 8	*	66103A-J09	Performance	81
30	3.3	100	1	*	66332A-J01	Mobile Communications	84
30	4	120	1	*	E3632A	Basic	21
30	17.5	500	1	*	6653A-J17	Performance	47
30	17.5	525	1		6553A-J17	Performance	51
30	25	750	1	*	N5745A	Basic	31
30	50	1500	1	*	N5765A	Basic	33
30	220	6600	1	*	6691A	Performance	67
32	160	5100	1	*	6683A	Performance	65
35	0.8	28	2	*	E3647A	Basic	24
35	0.8	30	1	*	E3641A	Basic	23
35	0.85	30	1		E3611A	Basic	17
35	1.25	40	up to 8	*	66105A-J01	Performance	81
35	1.4	49	2	*	E3649A	Basic	24
35	1.4	50	1	*	E3643A	Basic	23
35	1.5	50	up to 4	*	N6734B	Basic	75
35	1.7	60	1		E3616A	Basic	18
35	2.2	80	1	*	E3645A	Basic	24
35	3	80	3	*	6623A-J03	Performance	69
35	3	100	up to 4	*	N6744B	Basic	77
35	4.5	150	up to 8	*	66103A	Performance	79
35	6	210	1		6543A	Performance	43
35	6	210	1	*	6643A	Performance	40
35	15	525	1		6553A	Performance	50
35	15	525	1	*	6653A	Performance	46
35	60	2100	1		6573A	Performance	61

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## DC Power Supply Selection Index (Continued)

	Maximum Volts	Maximum Amps	Maximum Watts	Number of Outputs	GPIO	Model Number	Type	Page Number
	35	60	2100	1	*	6673A	Performance	54
	37	4	150	up to 8	*	66103A-J01	Performance	80
	37.5	45	1690	1		6573A-J03	Performance	62
	37.5	45	1690	1	*	6673A-J03	Performance	55
	40	3.6	100	up to 8	*	66103A-J02	Performance	80
	40	5	200	1	*	6643A-J11	Performance	41
	40	12.5	500	1		6553A-J04	Performance	51
	40	12.5	500	1	*	6653A-J04	Performance	47
	40	19	760	1	*	N5746A	Basic	31
	40	30	1200	1		6012B	Autoranging	25
	40	38	1520	1	*	N5766A	Basic	33
	40	50	2000	1		6573A-J08	Performance	62
	40	50	2000	1	*	6673A-J08	Performance	56
	40	128	5100	1	*	6684A	Performance	65
	43.5	11	480	1	*	E4350B-J04	Solar Array Simulator	92
	50	0.5	25	2	*	6625A	Performance	71
	50	0.5	25	4	*	6626A	Performance	71
	50	0.8	40	3	*	6623A	Performance	69
	50	0.8	40	4	*	6624A	Performance	69
	50	0.8	40	4	*	6627A	Performance	69
	50	1	50	1	*	6613C	Performance	36
	50	1	50	2	*	6625A	Performance	71
	50	1	50	4	*	6626A	Performance	71
	50	1	50	2	*	6628A	Performance	71
	50	1	50	4	*	6629A	Performance	71
	50	1.5	50	up to 4	*	N6761A	Performance	73
	50	2	80	2	*	6622A	Performance	69
	50	2	100	1	*	6633B	Performance	38
	50	3	100	up to 4	*	N6762A	Performance	73
	50	4	200	1	*	E3634A	Basic	21
	50	5	50	up to 4	*	N6751A	Performance	73
	50	10	500	1	*	6554A-J05	Performance	51
	50	10	500	1		6654A-J05	Performance	48
	50	10	100	up to 4	*	N6752A	Performance	73
	50	42	2000	1	*	6574A-J07	Performance	62
	50	42	2000	1	*	6674A-J07	Performance	56
	51.8	10	518	1	*	E4350B-J03	Solar Array Simulator	92
	54	9.6	480	1	*	E4350B-J01	Solar Array Simulator	91
	55	3	165	1	*	66104A-J09	Performance	81
	56	38	2000	1		6574A-J03	Performance	62

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## DC Power Supply Selection Index (Continued)

	Maximum Volts	Maximum Amps	Maximum Watts	Number of Outputs	GPB	Model Number	Type	Page Number
	56	38	2000	1	*	6674A-J03	Performance	56
	60	0.5	30	1		E3612A	Basic	17
	60	0.5	30	1	*	E3641A	Basic	23
	60	0.5	30	2	*	E3647A	Basic	24
	60	0.8	48	2	*	E3649A	Basic	24
	60	0.8	50	1	*	E3643A	Basic	23
	60	0.8	50	up to 4	*	N6735B	Basic	75
	60	1	60	1		E3617A	Basic	18
	60	1.3	80	1	*	E3645A	Basic	24
	60	1.6	100	up to 4	*	N6745B	Basic	77
	60	2.5	150	up to 8	*	66104A	Performance	79
	60	3.3	200	1	*	6038A	Autoranging	27
	60	3.5	210	1		6544A	Performance	43
	60	3.5	210	1	*	6644A	Performance	40
	60	9	540	1		6554A	Performance	50
	60	9	540	1	*	6654A	Performance	46
	60	12.5	750	1	*	N5747A	Basic	32
	60	17	1020	1		6010A	Autoranging	25
	60	17	1200	1	*	6030A	Autoranging	27
	60	17.5	1050	1		6012B	Autoranging	25
	60	17.5	1200	1	*	6032A	Autoranging	27
	60	25	1500	1	*	N5767A	Basic	34
	60	35	2100	1		6574A	Performance	61
	60	35	2100	1	*	6674A	Performance	54
	60	110	6600	1	*	6692A	Performance	67
	65	8	480	1	*	E4350B	Solar Array Simulator	91
	68	7	480	1	*	E4350B-J06	Solar Array Simulator	92
	70	3	200	1	*	6644A-J09	Performance	41
	70	3	200	1	*	6544A-J09	Performance	44
	70	7.5	500	1		6554A-J04	Performance	51
	70	7.5	500	1	*	6654A-J04	Performance	48
	80	6	480	1		6554A-J12	Performance	52
	80	6	500	1	*	6654A-J12	Performance	48
	80	9.5	760	1	*	N5748A	Basic	32
	80	19	1520	1	*	N5768A	Basic	34
	86	6	516	1	*	E4350B-J02	Solar Array Simulator	91
	100	0.5	50	1	*	6614C	Performance	36
	100	0.5	50	up to 4	*	N6736B	Basic	75
	100	1	100	1	*	6634B	Performance	38
	100	1	100	up to 4	*	N6746B	Basic	77

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## DC Power Supply Selection Index (Continued)

	Maximum Volts	Maximum Amps	Maximum Watts	Number of Outputs	GPIB	Model Number	Type	Page Number
	100	7.5	750	1	*	N5749A	Basic	32
	100	15	1500	1	*	N5769A	Basic	34
	100	22	2000	1		6575A-J08	Performance	63
	100	22	2000	1	*	6675A-J08	Performance	57
	110	20	2000	1		6575A-J09	Performance	63
	110	20	2000	1	*	6675A-J09	Performance	57
	120	0.25	30	1		E3612A	Basic	17
	120	1.25	150	up to 8	*	66105A	Performance	79
	120	1.5	180	1		6545A	Performance	43
	120	1.5	180	1	*	6645A	Performance	40
	120	4.5	540	1		6555A	Performance	50
	120	4	540	1	*	6655A	Performance	46
	120	18	2160	1		6575A	Performance	61
	120	18	2160	1	*	6675A	Performance	54
	130	4	480	1	*	E4351B	Solar Array Simulator	91
	135	16	2000	1		6575A-J06	Performance	63
	135	16	2000	1	*	6675A-J06	Performance	56
	150	1.2	150	1		6545A-J05	Performance	44
	150	1.2	150	1	*	6645A-J05	Performance	41
	150	3.2	500	1	*	6655A-J05	Performance	48
	150	5	750	1	*	N5750A	Basic	32
	150	10	1500	1	*	N5770A	Basic	34
	150	15	2000	1	*	6675A-J11	Performance	57
	150	15	2250	1		6575A-J11	Performance	63
	156	3	500	1		6555A-J10	Performance	52
	156	3	500	1	*	6655A-J10	Performance	48
	160	13	2000	1		6575A-J04	Performance	63
	160	13	2000	1	*	6675A-J04	Performance	54
	170	1	170	1	*	6645A-J06	Performance	41
	200	0.75	150	up to 8	*	66106A	Performance	79
	200	5	1000	1		6010A	Autoranging	25
	200	5	1000	1		6015A	Autoranging	25
	200	5	1000	1	*	6035A	Autoranging	27
	200	5	1200	1	*	6030A	Autoranging	27
	200	11	2000	1		6575A-J07	Performance	63
	300	2.5	750	1	*	N5751A	Basic	32
	300	5	1500	1	*	N5771A	Basic	34
	500	2	1000	1		6015A	Autoranging	25
	500	2	1000	1	*	6035A	Autoranging	27
	600	1.3	780	1	*	N5752A	Basic	32
	600	2.6	1560	1	*	N5772A	Basic	34

More detailed specifications at [www.agilent.com/find/power](http://www.agilent.com/find/power)

# DC Power Supply Feature Description Index


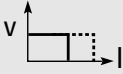
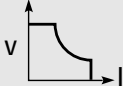
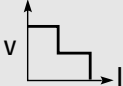
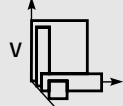
		6030 Series Autorangers													6610 & 6630 Series Single-Output													6620 Series Multiple-Output													6620 Series Precision Multiple-Output													6640 & 6650 Series Single-Output													6670-6690 Series Single-Output													66000 Modular Power Systems													E3630 & E3640 Series Mobile Communications													N3280A Precision Single & Multiple-Output													N5700 Series Multiple-Output													N6700 Series Single-Output												
DC Range	Max Power	200 W - 1000 W	40 W - 100 W	40 W & 80 W	25 W & 50 W	200 W - 500 W	2000 W - 6600 W	1200 W	40 W- 100 W	30 W - 200 W	5 W	700 W 1500 W	50 W 100W																																																																																																																																			
	Max Voltage	500 V	100 V	50 V	50 V	120 V	120 V	200 V	20 V	60 V	10 V	600 V	100 V																																																																																																																																			
	Max Current	120 A	10 A	10 A	2 A	50 A	875 A	16 A	5 A	20 A	0.5 A	180 A	20 A																																																																																																																																			
	Page	27	36	69	71	40	54	79	84	19	94	31	73																																																																																																																																			
Configuration Features																																																																																																																																																
<b>“One-box” solution</b> To preserve rack space and interconnections, the voltage and current programmers, current shunt, and DVM are built-in to one package.		•	•	•	•	•	•	•	•	•	•	•	•	•																																																																																																																																		
<b>Modular power system</b> (multiple reconfigurable outputs) Modules can be installed into a mainframe, and configuration can be changed at any time.								• Up to 8					• Up to 4																																																																																																																																			
<b>Multiple non-reconfigurable outputs</b> Up to four outputs are included in one package, and they share one GPIB address.				•	•				66309 B/D 66319 B/D	•	•																																																																																																																																					
<b>Serial link</b> Up to 16 power supply outputs can share one GPIB address when connected with a telephone style cable.		•				•	•	•																																																																																																																																								
<b>Relay connect, disconnect, &amp; polarity reversal</b> Optionally integrated with the power supply								•	• 66332A Only				• Disconnect only																																																																																																																																			
<b>Auto-parallel, auto-series, parallel, and series operation</b> When connected in auto-parallel or auto-series, only one unit has to be programmed to take advantage of the full power from all. <b>AP</b> =auto-parallel <b>AS</b> =auto-series <b>S</b> =series <b>P</b> =parallel		S AP		S P up to 2 identical outputs	S P up to 2 identical outputs	S AP	S AP	S, P		S, P		•	•																																																																																																																																			
<b>Analog programming and monitoring ports</b> Analog programming ports allow the power supply to be used as a power amplifier, responding to an external voltage signal. Monitoring ports allow an external DMM to monitor the power-supply outputs.		•				•	•					•																																																																																																																																				

For more detailed specifications see the product manual at [www.agilent.com/find/power](http://www.agilent.com/find/power)

# DC Power Supply Feature Description Index (Continued)

DC Range	Max Power	6030 Series Autorangers											
		6610 & 6630 Series Single-Output											
		6620 Series Multiple-Output											
		6640 & 6650 Series Precision Multiple-Output											
	Max Voltage	6670 - 6690 Series Single-Output											
		66000 Modular Power Systems											
		E3630 & E3640 Series Mobile Communications											
		N3280A Precision Single & Multiple-Output											
	Max Current	N5700 Series Single-Output											
		N6700 Series											
	Page												

## Output Voltage and Current Range Changing

<b>Single Range</b> The output voltage is limited by a single maximum value. The output current is limited by a single maximum value. 		•			•	•	•				•	• N6730 N6740	
<b>Single Range + Peak Current Pulse</b> A limited amplitude and limited width current pulse can be sourced beyond the maximum static current limit. 								•					
<b>Autoranging</b> A wide, continuous range of voltage and current combinations are available automatically at the maximum power level. 	•											• N6750 N6760	
<b>Multiple-output range changing</b> Automatic range changing gives maximum power to two different voltage and current combinations. 			•	•					•				
<b>Precision multiple-output range changing</b> Voltage and current ranges can be chosen independently to provide greater resolution. 				•								• N6760	

## Performance Characteristics

<b>Output ripple and noise</b> (Peak-to-peak, 20 Hz to 20 MHz)	30 - 160 mV	3 mV (10 mV to 25 mV in fast mode)	3 mV	3 mV	3 mV-7 mV	7 mV-25 mV	5-50 mV	3-10 mV	2-8 mV	4 mV	60-300 mV	6 mV N6750 N6760 10-30 mV N6730 N6740	
<b>Output programming response time</b> Rise and fall time with full resistive load (10 to 90% and 90 to 10%) Does not include command processing time.	200 W: (100 ms - 200 ms) 1000 W: (300 ms - 2000 ms)	2 ms (0.4 ms in fast mode)	2-6 ms	6 ms	15 ms	9 ms-195 ms	20 ms-50 ms	0.4 ms-2 ms	60 ms	150 µs	0.08 s to 0.30 s	*	
<b>Programming resolution</b> (percent of full scale)	0.025%	0.025%	0.03%	0.007%	0.025%	0.025%	0.03%	0.025%	0.025%/0.007%	0.003%	*	*	

\*See Datasheet or User's Guide for complete details

For more detailed specifications see the product manual at [www.agilent.com/find/power](http://www.agilent.com/find/power)

# DC Power Supply Feature Description Index (Continued)

DC Range	Max Power	200 W - 1000 W	40 W - 100 W	40 W & 80 W	25 W & 50 W	200 W - 500 W	2000 W - 6600 W	1200 W	40 W - 100 W	30 W - 200 W	5 W	700 W - 1500 W	50 W - 100 W	
	Max Voltage	500 V	100 V	50 V	50 V	120 V	120 V	200 V	20 V	60 V	10 V	600 V	100 V	
	Max Current	120 A	10 A	10 A	2 A	50 A	875 A	16 A	5 A	20 A	0.5 A	180 A	20 A	
	Page	00	00, 00	00	00	00, 00	00, 00, 00	00	00	00, 00	00	00	00	
GPIB Programming Features														
GPIB programming of voltage and current Self-documenting programming commands mean that programming is done in units of volts and amps, not in percentages or binary representations.		•	•	•	•	•	•	•	•	•	•	• GPIB LAN USB	• GPIB LAN USB	
Measured voltage and current read-back over the GPIB The output is read back in units of volts and amps.		•	•	•	•	•	•	•	•	•	•	•	•	
Store-recall states Complete operating states can be stored in nonvolatile memory. Each state specifies not only the output voltage and current, but also many of the programmable protection features.														
Number nonvolatile states (One of these states is automatically accessed on turn-on)		0	4	0	4	5	6670-5 6680-4 6690-4	5	4	5	0	1	2	
Number volatile states		16/5	0	10	7	0	0	5	0	0	0	0	0	
Standard Commands for Programmable Instruments (SCPI) SCPI is the standard language for test and measurement equipment. Standard codes make a software writing and maintenance more efficient. For example, using this standard, the output voltage of the power supply is measured with the same command (MEASURE: VOLTAGE?) by either a DMM or a power supply.		•	•			•	•	•	•	•	•	•	•	
Protection Features														
GPIB programmable overvoltage protection Can be enabled to quickly down-program the output and set SRQ and/or DFI/RI. T = Can generate trigger. M = Overvoltage, the level is set manually with a front-panel control.		M	•	T	T	•	•	T	•	•	•	T M	T	
GPIB programmable overcurrent protection Can be enabled to quickly down-program the output and set SRQ and/or DFI/RI. T = Can generate trigger.		•	•	•	•	•	•	T	•	E3630 only	•	T	T	
Overtemperature protection Will down-program the output and can be enabled to set SRQ and/or DFI. T = Can generate trigger.		•	•	•	•	•	•	T	•		•	T	T	

For more detailed specifications see the product manual at [www.agilent.com/find/power](http://www.agilent.com/find/power)



# DC Power Supply Feature Description Index (Continued)

DC Range	Max Power	200 W - 1000 W	40 W - 100 W	40 W & 80 W	25 W & 50 W	200 W - 500 W	2000 W - 6600 W	1200 W	40 W - 100 W	30 W - 200 W	5 W	700 W - 1500 W	50 W - 100 W
	Max Voltage	500 V	100 V	50 V	50 V	120 V	120 V	200 V	20 V	60 V	10 V	600 V	100 V
	Max Current	120 A	10 A	10 A	2 A	50 A	875 A	16 A	5 A	20 A	0.5 A	180 A	20 A
	Page	00	00, 00	00	00	00, 00	00, 00, 00	00	00	00, 00	00	00	00

## Protection Features (Continued)

<b>Discrete fault indicator/remote inhibit (DFI/RI)</b> Using these digital ports, power supplies can be connected independently of the GPIB. If any one experiences an error condition (overvoltage, for example), it can signal the other units to also downprogram their outputs. <b>0</b> = Optional	•	•	0	0	•	•	•	•				•	•
<b>SRQ</b> Almost any fault condition or change of state of the power supply can be enabled to generate an SRQ. This signals the computer to take the appropriate action.	•	•	•	•	•	•	•	•	•		•	•	•
<b>Local lockout</b> Front-panel or keyboard control can be disabled. This keeps unauthorized operators from changing the programmed states.	•	•	•	•	•	•	•	•	•	•		•	•
<b>Fan-speed control</b> Controls the fan-speed to provide only the required cooling, reducing unnecessary acoustic noise. <b>0</b> = Optional		•				•	•	•	•	•		•	•
<b>Active down-programming</b> Active circuits quickly drain the energy from the output when unit is programmed to a lower voltage. This means that a unit under test can be safely removed from its test fixture without danger of arcing. <b>F</b> = Full-rated output current <b>P</b> = Less than 100% rated output current	P	6610-P 6630-F	F	F	P	P	P	P	P				P N6750 N6760 only

## Maintenance Features

<b>Electronic calibration in the rack</b> Calibration requires no internal adjustments.		•	•	•	•	•	•	•	•	•	•	•	•
<b>Calibration security</b> Units can be protected from accidental access to calibration routines by either a password (P) or an internal jumper (J) or switch (S).		P, S	J	J	P, J	P, J	P, S	P, S	P, J	P	* P	* P	
<b>Self-test</b> Extensive self-test is triggered automatically on power-up. Additional tests can be initiated by user programming or front-panel control.	•	•	•	•	•	•	•	•	•	•	•	•	•

\* A nonvolatile status in SCPI mode only.

For more detailed specifications see the product manual at [www.agilent.com/find/power](http://www.agilent.com/find/power)

## Basic DC Power Supplies...

essential features  
for a tight budget

Agilent Basic DC Power Supplies are the right choice for many applications. They provide quiet, stable DC power for both manual and automatic testing, in R&D and in manufacturing environments, where speed and accuracy are low considerations. At their price level, they have a surprising level of capability.

If you do not need the performance level and features of Agilent High Performance DC Power Supplies, then choose Agilent Basic DC Power Supplies. This summary table will help you decide which family of DC power supplies best meets your needs.

Comparison Summary	Agilent Basic DC Power Supplies	Agilent High Performance DC Power Supplies
Output Power	30 W-1500 W	40 W-6,600 W
Number of outputs	1-3	1-8
GPIO programming and measurement speed	Moderate	Fast
Output rise/fall time	Moderate	Fast
Convenient 1/2 rack-size for bench-top use	Yes	No
Active Downprogrammer for enhanced test throughput	No	Yes
Stored wake-up state	No	Yes
Programmable Capabilities	Moderate	Extensive
Protection for the DUT	Moderate	Extensive

More detailed specifications at [www.agilent.com/find/power](http://www.agilent.com/find/power)



E3610A-E3617A

# Single-Output 30-60 W

Small, compact size for bench use  
Low-noise and excellent regulation  
Dual-range outputs (E3610A/11A/12A)

These linear-regulated DC power supplies provide reliable and convenient DC power on a lab bench. The 10-turn pots and clear voltage and current meters allow fine adjustments to be made easily. These models are CV/CC, so they can serve as either voltage or current sources. The “CC Set” button allows the current setting to be viewed, allowing easy adjustment of a current limit. Either the positive or negative terminal may be connected to ground, creating a positive or negative voltage, or floated up to 240 V from ground.

**E3610A, E3611A, E3612A**

These flexible 30 watt DC power supplies have 2 ranges, providing more current at lower voltage levels.

**E3614A, E3615A, E3616A, E3617A**

These DC power supplies provide remote sensing to eliminate the errors in voltage regulation due to voltage drops in the load leads. Delicate loads are protected by the overvoltage protection feature. Remote voltage signals can be used to control the power supply’s output voltage and current levels.

Specifications (at 0° to 55° C unless otherwise specified)	E3610A	E3611A	E3612A	E3614A
Number of output ranges	2	2	2	1
GPIO	No	No	No	No
Output ratings <sup>1</sup>				
Range 1	0 to 8 V, 0 to 3 A <sup>1</sup>	0 to 20 V, 0 to 1.5 A <sup>1</sup>	0 to 60 V, 0 to 0.5 A <sup>1</sup>	0 to 8 V, 0 to 6 A
Range 2	0 to 15 V, 0 to 2 A <sup>1</sup>	0 to 35 V, 0 to 0.85 A <sup>1</sup>	0 to 120 V, 0 to 0.25 A <sup>1</sup>	—
Power (max)	30 W	30 W	30 W	48 W
Load and line regulation	0.01% + 2 mV	0.01% + 2 mV	0.01% + 2 mV	0.01% + 2 mV
Ripple and noise				
from 20 Hz to 20 MHz				
Voltage rms	200 µV	200 µV	200 µV	200 µV
peak-peak	2 mV	2 mV	2 mV	1 mV
Supplemental Characteristics	(Non-warranted characteristics determined by design and useful in applying the product)			
Control mode	CV/CC	CV/CC	CV/CC	CV/CC
Meter resolution	Voltage	10 mV	100 mV	100 mV
(minimum change using front-panel controls)	Current	10 mA	10 mA	1 mA

☎ For Off-the-shelf shipment  
<sup>1</sup>Maximum current is derated 1% per °C between 40° to 55°C.

**Application Notes:**  
  
**Understanding Linear Power Supply Operation** (AN1554)  
5989-2291EN  
  
**10 Practical Tips You Need to Know About Your Power Products**  
5965-8239E

## Single-Output: 30-60 W (Continued)

Supplemental Characteristics  
for all model numbers

**Size:** E3610A-E3612A: 91 mm H x 213 mm W x 319 mm D (3.6 in x 8.4 in x 12.6 in); E3614A-E3617A: 91 mm H x 213 mm W x 373 mm D (3.6 in x 8.4 in x 14.7 in)

**Weight:** E3610A-E3612A: 3.8 kg (8.4 lb) net, 5.1 kg (11.3 lb) shipping; E3614A-E3617A: 5.5 kg (12.1 lb) net, 6.75 kg (14.9 lb) shipping

**Warranty:** One year

## Ordering Information

**Opt 0E9** 90 to 110 Vac, 47 to 63 Hz (Japan only)

**Opt 0EM** 104 to 126 Vac, 47 to 63 Hz

**Opt 0E3** 207 to 253 Vac, 47 to 63 Hz

**Opt 1CM** rack mount kit (E3614A-E3617A only)

**Opt 0L2** extra documentation package

## Specifications

(at 0° to 55°C unless otherwise specified)

## E3615A



## E3616A



## E3617A



Number of output ranges	1	1	1
GPIO	No	No	No
Output ratings <sup>1</sup>			
Range 1	0 to 20 V, 0 to 3 A	0 to 35 V, 0 to 1.7 A	0 to 60 V, 0 to 1 A
Range 2	—	—	—
Power (max)	60 W	60 W	60 W
Load and line regulation	0.01% + 2 mV	0.01% + 2 mV	0.01% + 2 mV
Ripple and noise			
from 20 Hz to 20 MHz			
Voltage rms	200 µV	200 µV	200 µV
peak-peak	1 mV	1 mV	1 mV

## Supplemental Characteristics

(Non-warranted characteristics determined by design and useful in applying the product)

Control mode		CV/CC	CV/CC	CV/CC
Meter resolution	Voltage	10 mV (0-20 V), 100 mV (>20 V)	10 mV (0-20 V), 100 mV (>20 V)	10 mV (0-20 V), 100 mV (>20 V)
(minimum change using front-panel controls)	Current	10 mA	1 mA	1 mA

For Off-the-shelf shipment

<sup>1</sup>Maximum current is derated 1% per °C between 40° to 55°C.



E3620A, E3630A

# Multiple-Output 35 W and 50 W

Dual and triple outputs  
Small, compact size for bench use  
Low-noise and excellent regulation  
Overload indicator to monitor output

These linear-regulated DC power supplies provide reliable and convenient DC power on a lab bench. Voltage and current can be monitored simultaneously on the front panel meters. There is also an overload indicator for each output.

### E3620A

The E3620A has two isolated, independent, CV/CL 25 volt outputs. It is easy to make precise adjustments using the 10-turn pots.

### E3630A

The E3630A triple output power supply has two 20 volt outputs and one 6 volt output. The +6V output is an isolated constant-voltage/current-foldback output, and both the +20 volt output and the -20 volt output are constant-voltage/current-limit. An autotracking feature lets you use one voltage control to adjust both 20 volt outputs. These outputs track each other to within one percent, making it easy to adjust the power supply for circuits requiring balance voltages. The  $\pm 20$  volt outputs are referenced together to a floating common.



### Application Notes:

Understanding Linear Power Supply Operation (AN1554)  
5989-2291EN


10 Practical Tips You Need to Know About Your Power Products  
5965-8239E

## Specifications

(at 0° to 55° C unless otherwise specified)

	E3620A	E3630A
		
Number of Outputs	2	3
GPIO	No	No
Output ratings*		
Output 1	0 to 25 V, 0 to 1 A	0 to 6 V, 0 to 2.5 A*
Output 2	0 to 25 V, 0 to 1 A	0 to +20 V, 0 to 0.5 A
Output 3	—	0 to -20 V, 0 to 0.5 A
Power (max)	50 W	35 W
Load regulation	0.01% + 2mV	0.01% + 2mV
Ripple and noise from 20 Hz to 20 MHz		
Normal mode voltage rms	350 $\mu$ V	350 $\mu$ V
peak-to-peak	1.5 mV	1.5 mV
Common mode current	1 $\mu$ Arms	1 $\mu$ Arms
Control mode	CV/CL	CV/CL ( $\pm 20$ V), CV/CL (6 V)
Meter resolution (Minimum change using front-panel controls)		
Voltage	10 mV (0-20 V), 100 mV, ( $>20$ V)	10 mV
Current	1 mA	10 mA
Input power	115 Vac $\pm 10\%$ , 47 to 63 Hz	115 Vac, $\pm 10\%$ , 47 to 63 Hz

\*Maximum current is derated 3.3% per °C from 40°C to 55°C

 For off-the-shelf shipment

### Supplemental Characteristics

Size: E3620A:  
213 mm W x 91 mm H x 401 mm D  
(8.4 in x 3.6 in x 15.8 in)  
E3630A:  
213 mm W x 92 mm H x 320 mm D  
(8.4 in x 3.6 in x 12.6 in)

Weight: E3620A: 5.5 kg (12.1 lbs)  
E3630A: 3.8 kg (8.4 lbs)

Warranty: Three years

### Ordering Information

Opt 0E9 90 to 110 Vac, 47 to 63 Hz  
(Japan only)  
Opt 0EM 104 to 126 Vac, 47 to 63 Hz  
Opt 0E3 207 to 253 Vac, 47 to 63 Hz  
Opt 1CM rack mount kit  
Opt 0L2 extra documentation package



E3631A

## Triple-Output 80 W GPIB

- Small, compact size for bench use
- Low output ripple and noise
- Built-in measurements and basic programmable features
- Over-voltage protection to ensure DUT safety

This is the DC power supply for every engineer's or electronic technician's lab bench. It has two tracking 25 V outputs, which are together referenced to a floating common, and an isolated 6 volt output. It is easy to control from the front panel, or with industry standard SCPI commands via the GPIB or RS232. *VXIPlug&Play* drivers are available to further simplify computer control. Up to 3 complete states can be stored for later recall. The low noise, excellent regulation, and built-in voltmeter/ammeter make this reliable power supply well suited for the needs of the R&D lab.

### Application Notes:

**Understanding Linear Power Supply Operation** (AN1554)  
5989-2291EN

**10 Practical Tips You Need to Know About Your Power Products**  
5965-8239E

### Supplemental Characteristics for all model numbers

**Product Regulation:** Designed to comply with UL1244, IEC 1010-1; certified with CSA 22.2  
Meets requirements for CE regulation

#### Software Driver:

- IVI-COM
- VXIPlug&Play*
- IntuiLink Connectivity Software

## Specifications

(at 0° to 55° C unless  
otherwise specified)

### E3631A

DC outputs			
Voltage	0 to +25 V	0 to -25 V	0 to 6 V
Current	0 to 1 A	0 to 1 A	0 to 5 A
Load regulation			
Voltage	<0.01% + 2 mV	<0.01% + 2 mV	<0.01% + 2 mV
Current	<0.01% + 250 µA	<0.01% + 250 µA	<0.01% + 250 µA
Line regulation			
Voltage	<0.01% + 2 mV	<0.01% + 2 mV	<0.01% + 2 mV
Current	<0.01% + 250 µA	<0.01% + 250 µA	<0.01% + 250 µA
Ripple and noise from 20 Hz to 20 MHz			
Normal-mode voltage	<350 µV rms/2 mV p-p	<350 µV rms/2 mV p-p	<350 µV rms/2 mV p-p
Normal-mode current	<500 µA rms	<500 µA rms	<2 mA rms
Common-mode current	<1.5 µA rms	<1.5 µA rms	<1.5 µA rms
Programming accuracy at 25° C ±5° C			
Voltage	0.05% + 20 mV	0.05% + 20 mV	0.1% + 5 mV
Current	0.15% + 4 mA	0.15% + 4 mA	0.2% + 10 mA
Readback accuracy at 25° C ±5° C			
Voltage	0.05% + 10 mV	0.05% + 10 mV	0.1% + 5 mV
Current	0.15% + 4 mA	0.15% + 4 mA	0.2% + 10 mA
Resolution			
Program/readback	1.5 mV, 0.1 mA	1.5 mV, 0.1 mA	0.5 mV, 0.5 mA
Meter	10 mV, 1 mA	10 mV, 1 mA	1 mV, 1 mA
Transient response			
50 µsec for output to recover to within 15 mV following a change in output current from full load to half load or vice versa			

☎ For off-the-shelf shipment

**Warranty:** One year

**Size: E3631A**  
213 mm W x 133 mm H x 348 mm D  
(8.4 in. x 5.2 in. x 14.2 in.)

**Weight: E3631A**  
8.2 kg (18 lbs)

### Ordering Information

**Opt 0E9** 90 to 110 Vac, 47 to 63 Hz  
(Japan only)

**Opt 0EM** 104 to 126 Vac, 47 to 63 Hz

**Opt 0E3** 207 to 253 Vac, 47 to 63 Hz

**Opt 1CM** rack mount kit

**Opt 0L2** extra documentation package

More detailed specifications at [www.agilent.com/find/E3600](http://www.agilent.com/find/E3600)



E3632A-E3634A

## Single-Output 120 W to 200 W GPIB

- Dual range outputs
- Small, compact size for bench use
- Low output ripple and noise
- Built-in measurements and basic programmable features
- Protection features to ensure DUT safety




These dual range DC power supplies provide the stable, accurate, and reliable DC power that the R&D engineer needs. These models are CV/CC, so they can serve as either voltage or current sources. They can be used either for manual or automated testing where moderate speed and accuracy are required. *VXIPlug&Play* drivers further simplify computer control.

These DC power supplies have many features to help the R&D engineer to quickly and easily bias and monitor prototype circuitry. Remote sensing eliminates the errors in voltage regulation due to voltage drops in the load leads. Delicate prototypes are protected by overvoltage and overcurrent protection features. Up to 3 frequently used operating states may be stored for later recall. The output is isolated from chassis ground.


For applications where even higher accuracy is needed, or speed must be optimized, see the Agilent 6600 Series of performance DC power supplies.

### Specifications

(at 0° to 55° C unless otherwise specified)

	E3632A 	E3633A 	E3634A 
<b>Number of Outputs</b>	1	1	1
<b>GPIB</b>	Yes	Yes	Yes
<b>Output ratings</b>			
Range 1	0 to 15 V, 7 A	0 to 8 V, 20 A	0 to 25 V, 7 A
Range 2	0 to 30 V, 4 A	0 to 20 V, 10 A	0 to 50 V, 4 A
<b>Load regulation</b>			
Voltage	<0.01% + 2 mV	<0.01% + 2 mV	<0.01% + 2 mV
Current	<0.01% + 250 µA	<0.01% + 250 µA	<0.01% + 250 µA
<b>Line regulation</b>			
Voltage	<0.01% + 2 mV	<0.01% + 2 mV	<0.01% + 2 mV
Current	<0.01% + 250 µA	<0.01% + 250 µA	<0.01% + 250 µA
<b>Ripple and noise</b> from 20 Hz to 20 MHz			
Normal-mode voltage	<350 µVrms/2 mVpp	<350 µVrms/3 mVpp	<500 µVrms/3 mVp-p
Normal-mode current	<2 mA rms	<2 mA rms	<2 mA rms
Common-mode current	<1.5 µA rms	<1.5 µA rms	<1.5 µA rms
<b>Programming accuracy</b> at 25° C ±5° C			
Voltage	0.05% + 10 mV	0.05% + 10 mV	0.05% + 10 mV
Current	0.2% + 10 mA	0.2% + 10 mA	0.2% + 10 mA
<b>Readback accuracy</b> at 25° C ±5° C			
Voltage	0.05% + 5 mV	0.05% + 5 mV	0.05% + 5 mV
Current	0.15% + 5 mA	0.15% + 5 mA	0.15% + 5 mA
<b>Resolution</b>			
Program	1 mV, 0.5 mA	1 mV, 1 mA	3 mV, 0.5 mA
Readback	0.5 mV, 0.1 mA	0.5 mV, 1 mA	1.5 mV, 0.5 mA
Meter	1 mV, 1 mA	1 mV, 1 mA (<10 A/10 mA (≥10 A))	1 mV, 1 mA (<10 A/10 mA (≥10 A))
<b>Transient response</b>	50 µsec for output to recover to within 15 mV following a change in output current from full load to half load or vice versa		

\* Maximum current is derated 1% per °C from 40°C to 55°C %

 For off-the-shelf shipment

## Single-Output: 120 W to 200 W (Continued)

### Application Notes:

**Understanding Linear  
Power Supply Operation** (AN1554)  
5989-2291EN

**10 Practical Tips You Need to  
Know About Your Power Products**  
5965-8239E

**Modern Connectivity -  
Using USB and LAN I/O Converters**  
(AN 1475-1)  
5989-0123EN

### Supplemental Characteristics for all model numbers

**Product Regulation:** Designed to  
comply with UL1244, IEC 61010-1;  
certified with CSA 22.2  
Meets requirements for CE regulation

#### Software Driver:

- IVI-COM
- *VXIPlug&Play*
- IntuiLink Connectivity Software

**Warranty:** One year

**Size:** 213 mm W x 132 mm H x 348 mm D  
(8.4 in. x 5.2 in. x 13.7 in.)

**Weight:** 9.5 kg (21 lbs)

### Ordering Information

**Opt 0E9** 90 to 110 Vac, 47 to 63 Hz  
(Japan only)

**Opt 0EM** 104 to 126 Vac, 47 to 63 Hz

**Opt 0E3** 207 to 253 Vac, 47 to 63 Hz

**Opt 1CM** rack mount kit

**Opt 0L2** extra documentation package





E3640A-E3649A

## Single & Dual Output 30-100 W GPIB

- Dual range outputs
- Small, compact size for bench and system use
- Low output ripple and noise
- Built-in measurements and basic programmable features
- Over-voltage protection to ensure DUT safety

These isolated dual range DC power supplies provide the stable and reliable DC power that the manufacturing test system designer needs. These models offer constant-voltage/constant-current outputs, so they can serve as either voltage or current sources. They can be used either for manual or automated testing, and have *VXIPlug&Play* drivers to further simplify computer control.

The E3640A Series DC power supplies can be quickly integrated into a test system. Both front and rear panel terminals are provided for easy wiring. Remote sensing eliminates the errors in voltage regulation due to voltage drops in the load leads. Delicate DUTs are protected by overvoltage protection. Up to 5 operating states can be stored for later recall.

The E3640A Series DC power supplies are intended for manufacturing test systems where moderate speed and accuracy are required. For systems which require even higher accuracy for programming or measurement, or where test throughput must be optimized, consider the Agilent 6600A and N6700 Series of Performance DC Power Supplies.

### Specifications

(at 0° to 55° C unless otherwise specified)

	E3640A	E3641A	E3642A	E3643A	E3644A
<b>Number of outputs</b>	1	1	1	1	1
<b>GPIB</b>	Yes	Yes	Yes	Yes	Yes
<b>DC outputs</b>					
Voltage	0 to 8 V	0 to 35 V	0 to 8 V	0 to 35 V	0 to 8 V
Current	3 A	0.8 A	5 A	1.4 A	8 A
Voltage	0 to 20 V	0 to 60 V	0 to 20 V	0 to 60 V	0 to 20 V
Current	1.5 A	0.5 A	2.5 A	0.8 A	4 A
<b>Power (max)</b>	30 W	30 W	50 W	50 W	80 W
<b>Load and line regulation</b>					
Voltage	<0.01% + 3 mV	<0.01% + 3 mV	<0.01% + 3 mV	<0.01% + 3 mV	<0.01% + 3 mV
Current	<0.01% + 250 $\mu$ A	<0.01% + 250 $\mu$ A	<0.01% + 250 $\mu$ A	<0.01% + 250 $\mu$ A	<0.01% + 250 $\mu$ A
<b>Ripple and noise</b> from 20 Hz to 20 MHz					
Normal-Mode Voltage	<500 $\mu$ Vrms 5 mVp-p	<1 mVrms 8 mVp-p	<500 $\mu$ Vrms 5 mVp-p	<1 mVrms 8 mVp-p	<500 $\mu$ Vrms 5 mVp-p
Normal-Mode Current	<4.0 mArms	<4.0 mArms	<4.0 mArms	<4.0 mArms	<4.0 mArms
Common-Mode Current	<1.5 $\mu$ Arms	<1.5 $\mu$ Arms	<1.5 $\mu$ Arms	<1.5 $\mu$ Arms	<1.5 $\mu$ Arms
<b>Programming accuracy</b> at 25° C $\pm$ 5° C					
Voltage	<0.05% + 10 mV	10 mV	10 mV	10 mV	10 mV
Current	<0.2% + 10 mA	10 mA	10 mA	10 mA	10 mA
<b>Readback accuracy</b> at 25° C $\pm$ 5° C					
Voltage	<0.05% + 5 mV	5 mV	5 mV	5 mV	5 mV
Current	<0.15% + 5 mA	5 mA	5 mA	5 mA	5 mA
<b>Program resolution</b>					
Voltage	5 mV	5 mV	5 mV	5 mV	5 mV
Current	1 mA	1 mA	1 mA	1 mA	1 mA
<b>Readback resolution</b>					
Voltage	2 mV	2 mV	2 mV	2 mV	2 mV
Current	1 mA	1 mA	1 mA	1 mA	1 mA
<b>Meter resolution</b>					
Voltage	10 mV	10 mV	10 mV	10 mV	10 mV
Current	1 mA	1 mA	1 mA	1 mA	1 mA
<b>Transient response</b>	<50 $\mu$ sec for output to recover to within 15 mV following a change in output current from full load to half load or vice versa.				

\* Maximum current is derated 1% per °C from 40° C to 55° C

More detailed specifications at [www.agilent.com/find/E3600](http://www.agilent.com/find/E3600)

## Single &amp; Dual Output: 30-100 W GPIB (Continued)

## Application Notes:

## Understanding Linear Power Supply Operation (AN1554)

5989-2291EN

## 10 Practical Tips You Need to Know About Your Power Products

5965-8239E

## Modern Connectivity - Using USB and LAN I/O Converters (AN 1475-1)

5989-0123EN

## Supplemental Characteristics for all model numbers

**DC Floating Voltage:** Output terminals can be floated up to  $\pm 240$  Vdc from chassis ground

**Remote Sensing:** Up to 1 V can be dropped in each load lead. The drop in the load leads subtracts from the voltage available for the load.

**Settling Time:** Less than 90msec for the output voltage to change from 1% to 99% or vice versa following the receipt of VOLTage or APPLy command via direct GPIB or RS-232 interface.

## Product Regulation:

Designed to comply with UL3111-1; certified to CSA 22.2 No. 1010.1; conforms to IEC 1010-1; complies with EMC directive 89/336/EEC(Group1, Class A)

**OVP Accuracy:** 0.5% + 0.5 V, activation time:  $\geq 3$  V,  $< 1.5$  ms, and  $< 3$  V,  $< 10$  ms

**Isolation:**  $\pm 240$  Vdc

**Stability:** Voltage  $< 0.02\% + 2$  mV; Current  $< 0.1\% + 1$  mA

**Temperature Coefficient:**  $< 0.01\% + 3$  mV,  $< 0.02\% + 3$  mA change per  $^{\circ}\text{C}$  over operating range 0-40  $^{\circ}\text{C}$  after 30 minute warm-up

## Software Driver:

- IVI-COM
- VXIPlug&Play
- IntuiLink Connectivity Software

**Warranty Period:** One year

## Specifications

(at 0  $^{\circ}$  to 55  $^{\circ}\text{C}$  unless otherwise specified)

	E3645A	E3646A	E3647A	E3648A	E3649A
<b>Number of outputs</b>	1	2	2	2	2
<b>GPIB</b>	Yes	Yes	Yes	Yes	Yes
<b>DC outputs</b>					
Voltage	0 to 35 V	0 to 8 V	0 to 35 V	0 to 8 V	0 to 35 V
Current	2.2 A	3 A	0.8 A	5 A	1.4 A
Voltage	0 to 60 V	0 to 20 V	0 to 60 V	0 to 20 V	0 to 60 V
Current	1.3 A	1.5 A	0.5 A	2.5 A	0.8 A
<b>Power (max)</b>	80 W	60 W	60 W	100 W	100 W
<b>Load and line regulation</b>					
Voltage	$< 0.01\% + 3$ mV	3 mV	3 mV	3 mV	3 mV
Current	$< 0.01\% + 250$ $\mu\text{A}$	250 $\mu\text{A}$	250 $\mu\text{A}$	250 $\mu\text{A}$	250 $\mu\text{A}$
<b>Ripple and noise</b> from 20 Hz to 20 MHz					
Normal-Mode Voltage	$< 1$ mVrms 8 mVp-p	$< 500$ $\mu\text{Vrms}$ 5 mVp-p	$< 1$ mVrms 8 mVp-p	$< 500$ $\mu\text{Vrms}$ 5 mVp-p	$< 1$ mVrms 8 mVp-p
Normal-Mode Current	$< 4.0$ mArms	$< 4.0$ mArms	$< 4.0$ mArms	$< 4.0$ mArms	$< 4.0$ mArms
Common-Mode Current	$< 1.5$ $\mu\text{Arms}$	$< 1.5$ $\mu\text{Arms}$	$< 1.5$ $\mu\text{Arms}$	$< 1.5$ $\mu\text{Arms}$	$< 1.5$ $\mu\text{Arms}$
<b>Programming accuracy</b> at 25 $^{\circ}\text{C} \pm 5^{\circ}\text{C}$					
Voltage	$< 0.05\% +$ ( $< 0.1\% + 25$ mA for output 2)	10 mV	10 mV	10 mV	10 mV
Current	$< 0.2\% +$	10 mA	10 mA	10 mA	10 mA
<b>Readback accuracy</b> at 25 $^{\circ}\text{C} \pm 5^{\circ}\text{C}$					
Voltage	$< 0.05\% +$ ( $< 0.1\% + 25$ mV for output 2)	5 mV	5 mV	5 mV	5 mV
Current	$< 0.15\% +$ ( $< 0.15\% + 10$ mA for output 2)	5 mA	5 mA	5 mA	5 mA
<b>Program resolution</b>					
Voltage	5 mV	5 mV	5 mV	5 mV	5 mV
Current	1 mA	1 mA	1 mA	1 mA	1 mA
<b>Readback resolution</b>					
Voltage	2 mV	2 mV	2 mV	2 mV	2 mV
Current	1 mA	1 mA	1 mA	1 mA	1 mA
<b>Meter resolution</b>					
Voltage	10 mV	10 mV	10 mV	10 mV	10 mV
Current	1 mA	1 mA	1 mA	1 mA	1 mA
<b>Transient response</b>	$< 50$ $\mu\text{sec}$ for output to recover to within 15 mV following a change in output current from full load to half load or vice versa.				

\*Maximum current is derated 1% per  $^{\circ}\text{C}$  from 40  $^{\circ}\text{C}$  to 55  $^{\circ}\text{C}$ 

## Size: (E3640A-E3645A)

254.4 mm W x 104 mm H x 374 mm D  
(10 in. x 4.1 in. x 14.8 in.)  
(E3646A-E3649A)

213 mm W x 133 mm H x 348 mm D  
(8.4 in. x 5.2 in. x 13.7 in.)

**Weight:** E3640A, E3641A: 5.3 kg (11.7 lbs)  
E3642A, E3643A: 6.2 kg (13.7 lbs)  
E3644A, E3645A: 6 kg (13.2 lbs)  
E3646A, E3647A: 7.4 kg (16.3 lbs)  
E3648A, E3649A: 9.5 kg (20.9 lbs)

## Ordering Information

**Opt 0E3** 207 to 253 Vac, 47 to 63 Hz

**Opt 0E9** 90 to 110 Vac,  
47 to 63 Hz (Japan only)

**Opt 0EM** 104 to 126 Vac, 47 to 63 Hz

**Opt 1CM** Rack mount kit  
(E3640A-E3645A p/n 5063-9240;  
E3646A-E3649A p/n 5063-9243)

**Opt 0L2** Extra documentation package

**Opt 0B0** Delete documentation

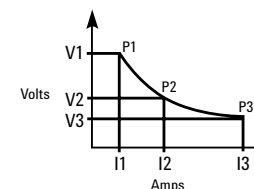
More detailed specifications at [www.agilent.com/find/E3600](http://www.agilent.com/find/E3600)



6010A, 6011A, 6012B, 6015A

## Single-Output, Autoranging 200 W and 1000 W

Autoranging Output:



Autoranging outputs provide maximum power  
at a variety of operating voltages

Analog/resistance control of output voltage and current

Series and auto-parallel connections enable greater output flexibility

Protection features to ensure DUT safety

This series of DC power supplies take the place of multiple power supplies on your test bench by providing maximum power at a variety of operating points. They have ten-turn front panel pots to allow precise local control. These power supplies also may be connected in auto-parallel or series with their corresponding GPIB unit (6030 Series), as part of a test system.

### Application Notes:

**10 Practical Tips You Need to Know  
About Your Power Products**  
5965-8239E

### Specifications

(at 0° to 55° C unless  
otherwise specified)

		6010A	6011A	6012B	6015A
<b>Number of outputs</b>		1	1	1	1
<b>GPIB</b>		No	No	No	No
<b>Output ratings</b>					
Voltage		0 to 200 V	0 to 20 V	0 to 60 V	0 to 500 V
Current		0 to 17 A	0 to 120 A	0 to 50 A	0 to 5 A
<b>Maximum power</b>					
Watts		1,200 W	1,064 W	1,200 W	1,050 W
<b>Autoranging output</b>	V1, I1	200 V, 5 A	20 V, 50 A	60 V, 17.5 A	500 V, 2 A
	V2, I2	120 V, 10 A	14 V, 76 A	40 V, 30 A	350 V, 3 A
	V3, I3	60 V, 17 A	7 V, 120 A	20 V, 50 A	200 V, 5 A
<b>Ripple and noise, 20 Hz to 20 MHz</b>					
Voltage rms		22 mV	8 mV	8 mV	50 mV
p-p		50 mV	50 mV	40 mV	160 mV
Current rms		15 mA	120 mA	25 mA	50 mA
<b>Load regulation</b>					
Voltage	0.01%+	5 mV	3 mV	5 mV	13 mV
Current	0.01%+	10 mA	15 mA	10 mA	35 mA
<b>Transient response time</b>					
10% step change					
Time		2 ms	2 ms	2 ms	5 ms
Level		150 mV	100 mV	100 mV	200 mV
<b>Supplemental Characteristics</b>	(Non-warranted characteristics determined by design that are useful in applying the product)				
<b>Programming resolution</b>					
Voltage		50 mV	5 mV	15 mV	125 mV
Current		4.25 mA	30 mA	12.5 mA	1.25 mA
<b>DC floating voltage</b>					
either terminal can be grounded or floated from chassis ground		±550 V	±240 V	±240 V	±550 V
<b>AC input current</b>	100 Vac	24 A	24 A	24 A	24 A
	120 Vac	24 A	24 A	24 A	24 A
	220 Vac	15 A	15 A	15 A	15 A
	240 Vac	14 A	14 A	14 A	14 A
<b>Weight</b>	Net	16.3 kg (36 lb)	17.2 kg (38 lb)	16.3 kg (36 lb)	16.3 kg (36 lb)
	Shipping	21.8 kg (48 lb)	22.7 kg (50 lb)	21.8 kg (48 lb)	21.8 kg (48 lb)

## Single-Output, Autoranging 200 W and 1000 W (Continued)

### Supplemental Characteristics for all model numbers

**Remote Sensing:** Up to 2 V drop in each lead. Voltage regulation specification met with up to 0.5 V drop, but degrades for greater drops.

**Modulation:** (analog programming of output voltage and current)

**Input signal:** 0 to 5 V or 0 to 4 k Ohms

**Regulatory Compliance:** Certified to CSA556B; conforms to IEC 61010-1.

**Size:** 425.5 mm W x 132.6 mm H x 516.4 mm D  
(16.75 in x 5.25 in x 20.33 in).

**Warranty:** One year

### Ordering Information

**Opt 120** 104 to 127 Vac, 47 to 63 Hz

**Opt 220** 191 to 233 Vac, 48 to 63 Hz

**Opt 240** 209 to 250 Vac, 48 to 63 Hz

\* **Opt 908** Rack-mount Kit (p/n 5062-3977)

\* **Opt 909** Rack-mount Kit with Handles.  
(p/n 5062-3983)

**Opt 0L1** Full documentation on CD-ROM, and printed standard documentation package

**Opt 0L2** Extra copy of standard printed documentation package

**Opt 0B0** Full documentation on CD-ROM only

**Opt J01** Stabilization for loads up to 10 Henries

**A line cord option must be specified, see the AC line voltage and cord section.**

\*Support rails required

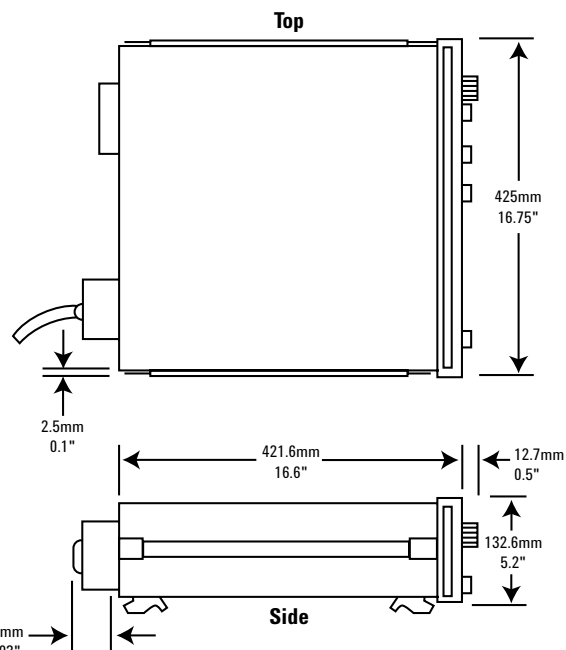
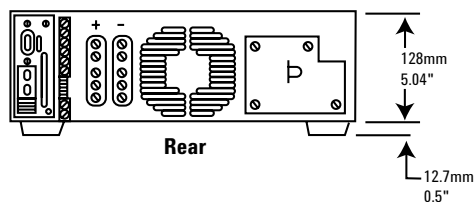
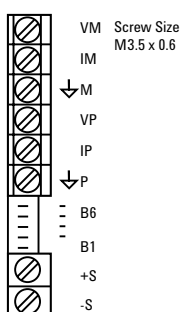
### Accessories

**1494-0060** Rack Slide Kit

**E3663AC** Support rails for Agilent rack cabinets

**Agilent Models: 6010A, 6011A, 6012B, 6015A**

### Terminal Strip Detail



More detailed specifications at [www.agilent.com/find/6010](http://www.agilent.com/find/6010)



6030A, 6031A, 6032A, 6033A, 6035A, 6038A

## Single-Output, Autoranging 200 W and 1000 W GPIB

Autoranging outputs provide maximum power at a variety of operating voltages

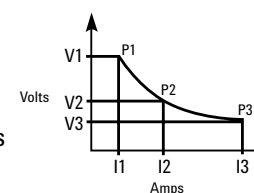
Analog/resistance control of output voltage and current

Series and auto-parallel connections of multiple supplies

Built-in measurements and advanced programmable features

Protection features to ensure DUT safety

Autoranging Output:



This series of 200 watt and 1000 watt DC power supplies take the place of multiple power supplies in your test system by providing maximum power at a variety of operating points.

Industry standard SCPI commands and VXIPlug&Play drivers make system integration easy. Using the serial link, up to 16 power supplies can be connected through one GPIB address. These power supplies have excellent electrical efficiency, making them a good choice for large systems.

### Application Notes:

#### 10 Hints for Using Your Power Supply to Decrease Test Time

5968-6359E

#### 10 Practical Tips You Need to Know About Your Power Products

5965-8239E

#### Agilent DC Power Supplies for Base Station Testing

5988-2386EN

### Specifications

(at 0° to 55°C unless otherwise specified)

		6030A	6031A	6032A	6033A	6035A	6038A
<b>Number of outputs</b>		1	1	1	1	1	1
<b>GPIB</b>		Yes	Yes	Yes	Yes	Yes	Yes
<b>Output ratings</b>							
Output Voltage		0 to 200 V	0 to 20 V	0 to 60 V	0 to 20 V	0 to 500 V	0 to 60 V
Output Current		0 to 17 A	0 to 120 A	0 to 50 A	0 to 30 A	0 to 5 A	0 to 10 A
<b>Maximum power watts</b>		1,200 W	1,064 W	1,200 W	242 W	1,050 W	240 W
<b>Autoranging output</b>	V1, I1	200 V, 5 A	20 V, 50 A	60 V, 17.5 A	20 V, 10 A	500 V, 2 A	60 V, 3.3 A
	V2, I2	120 V, 10 A	14 V, 76 A	40 V, 30 A	14 V, 17.2 A	350 V, 3 A	40 V, 6 A
	V3, I3	60 V, 17 A	7 V, 120 A	20 V, 50 A	6.7 V, 30 A	200 V, 5 A	20 V, 10 A
<b>Programming accuracy</b>	Voltage	0.035% +145 mV	0.035% +15 mV	0.035% +40 mV	0.035% +9 mV	0.25% +400 mV	0.035% +40 mV
	Current	0.2% +25 mA	0.25% +250 mA	0.2% +85 mA	0.15% +20 mA	0.3% +63 mA	0.09% +10 mA
<b>Ripple and noise</b>	Voltage rms 20 Hz to 20 MHz p-p	22 mV 50 mV	8 mV 50 mV	8 mV 40 mV	3 mV 30 mV	50 mV 160 mV	3 mV 30 mV
	Current rms	15 mA	120 mA	25 mA	30 mA	50 mA	5 mA
<b>Readback accuracy</b>	Voltage	0.08% +80 mV	0.08% +7 mV	0.08% +20 mV	0.07% +6 mV	0.5% +200 mV	0.07% +50 mV
	Current	0.36% +15 mA	0.4% +100 mA	0.36% +35 mA	0.3% +25 mA	0.5% +50 mA	0.2% +11 mA
<b>Load regulation</b>							
Voltage	0.01%+	5 mV	3 mV	5 mV	2 mV	40 mV	3 mV
Current	0.01%+	10 mA	15 mA	10 mA	9 mA	34 mA	5 mA
<b>Line regulation</b>							
Voltage	0.01%+ 5 mV	0.01%+ 2 mV	0.01%+ 3 mV	0.01%+ 1 mV	0.03%+ 17 mV	0.01%+ 2 mV	
Current	0.01%+ 5 mA	0.01%+ 25 mA	0.01%+ 10 mA	0.01%+ 6 mA	0.03%+ 17 mA	0.01%+ 2 mA	
<b>Transient response time</b>	Time Level	2 ms 150 mV	2 ms 100 mV	2 ms 100 mV	1 ms 50 mV	5 ms 200 mV 7	1 ms 5 mV

More detailed specifications at [www.agilent.com/find/6030](http://www.agilent.com/find/6030)

Autoranging: 200 W and 1000 W GPIB (Continued)

Specifications

(at 0° to 55° C unless otherwise specified)

6030A

6031A

6032A

6033A

6035A

6038A

Supplemental Characteristics for all model numbers

**Remote Sensing:** Up to 2 V drop in each lead. Voltage regulation specification met with up to 0.5 V drop, but degrades for greater drops.

**Modulation:** (analog programming of output voltage and current)  
Input signal: 0 to 5 V or 0 to 4 k Ohms

**Software Driver:**  
VXIPlug&Play

**Warranty:** One year

**Size:** 6030A–32A, 6035A:  
425.5 mm W x 132.6 mm H x 503.7 mm D  
(16.75 in x 5.25 in x 19.83 in).  
6033A, 6038A:  
212.3 mm W x 177.0 mm H x 516.4 mm D  
(8.36 in x 6.97 in x 17.87 in).

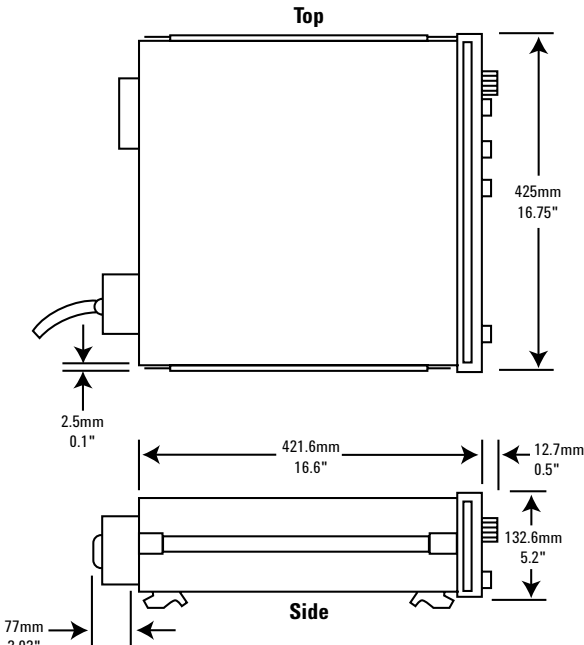
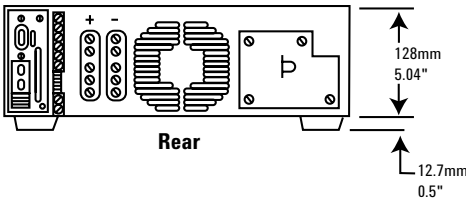
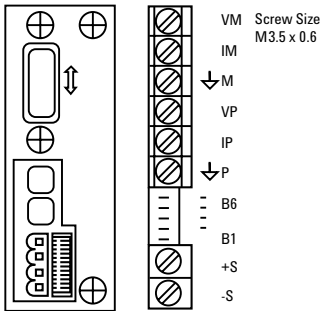
Supplemental Characteristics

(Non-warranted characteristics determined by design and useful in applying the product)

Programming resolution	Voltage	50 mV	5 mV	15 mV	5 mV	125 mV 1	5 mV
	Current	4.25 mA	30 mA	12.5 mA	7.5 mA	1.25 mA	2.5 mA
DC floating voltage		±550 V	±240 V	±240 V	±240 V	±550 V	±240 V
either terminal can be grounded or floated from chassis ground							
AC input current	100 Vac	24 A	24 A	24 A	6 A	24 A	6 A
	120 Vac	24 A	24 A	24 A	6.5 A	24 A	6.5 A
	220 Vac	15 A	15 A	15 A	3.8 A	15 A	3.8 A
	240 Vac	14 A	14 A	14 A	3.6 A	14 A	3.6 A
Weight	Net	16.3 kg (36 lb)	17.2 kg (38 lb)	16.3 kg (36 lb)	9.6 kg (21 lb)	16.3 kg (36 lb)	9.6 kg (21 lb)
	Shipping	21.8 kg (48 lb)	22.7 kg (50 lb)	21.8 kg (48 lb)	11.4 kg (25 lb)	21.8 kg (48 lb)	11.4 kg (25 lb)

Agilent Models: 6030A, 6031A, 6032A, 6035A

Terminal Strip Detail



More detailed specifications at [www.agilent.com/find/6030](http://www.agilent.com/find/6030)

## Autoranging: 200 W and 1000 W GPIB (Continued)

### Ordering Information

**Opt 001** Front panel has only line switch, line indicator, and OVP adjust (6030A–33A and 6038A only)

**Opt 100** 87 to 106 Vac, 48 to 63 Hz (power supply output is derated to 75%)

**Opt 120** 104 to 127 Vac, 47 to 63 Hz

**Opt 220** 191 to 233 Vac, 48 to 63 Hz

**Opt 240** 209 to 250 Vac, 48 to 63 Hz

**Opt 800** Rack-mount Kit for Two Half-rack Units Side by Side.

Lock link Kit p/n 5061-9694 and 7 in Rack adapter Kit 5063-9215

\* **Opt 908** Rack-mount Kit for a Single Half-rack Unit 6033A and 6038A (with blank filler panel); p/n 5062-3960, 6030A–32A and 6035A; p/n 5062-3977

\* **Opt 909** Rack-mount Kit with Handles. For 6030A–32A, 6035A; p/n 5062-3983

**Opt 0L1** Full documentation on CD-ROM, and printed standard documentation package

**Opt 0L2** Extra copy of standard printed documentation package

**Opt 0B3** Service Manual

**Opt 0B0** Full documentation on CD-ROM only

**Opt J01** Stabilization for loads up to 10 Henries (not available on 6033A)

**A line cord option must be specified, see the AC line voltage and cord section.**

\* Support rails required

### Accessories

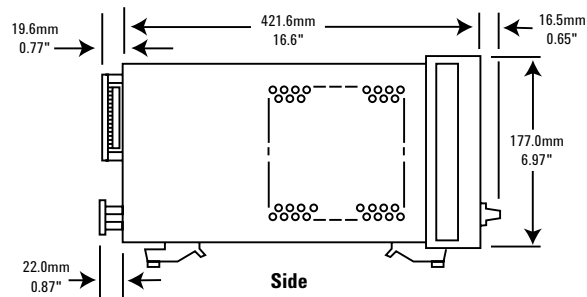
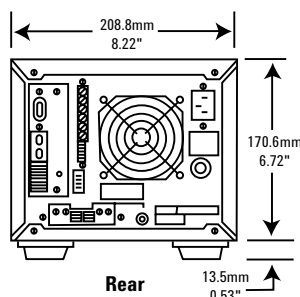
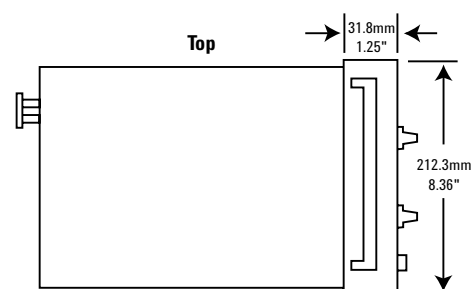
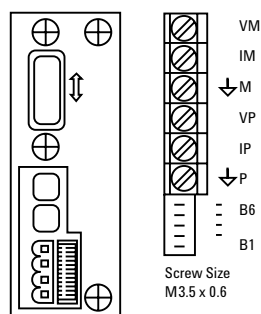
**5080-2148** Serial Link Cable, 2 m (6.6 ft)

**1494-0060** Rack Slide Kit

**E3663AC** Support rails for Agilent rack cabinets

### Agilent Models: 6033A, 6038A

#### Terminal Strip Detail



More detailed specifications at [www.agilent.com/find/6030](http://www.agilent.com/find/6030)

# Single-Output

## 750 W & 1500 W GPIB, LAN, USB

N5741A\*



N5741A - N5772A

- Small size: 1 U high
- Universal AC input (85-265 Vac)
- Analog/resistance control of output voltage and current
- Parallel and series connection of multiple supplies
- Built-in measurements and advanced programmable features
- Protection features to ensure DUT safety



The N5700 Series is a family of affordable 750 W and 1500 W switching regulated, single-output programmable DC power supplies. They offer 24 models for simple DC power application where speed and accuracy are not the primary concern. They provide stable output power, built-in voltage and current measurement, and output voltage and current from 6 V to 600 V and 1.3 A to 180 A.

### Small, High-Density Package

The N5700 provides up to 1500 W in a small space-saving 1 U-high, 19-inch wide package. Its air vents are in the front, side and rear (not on the top or bottom), so you can stack other instruments directly above or below it to save valuable rack space.

### Universal AC input

All models have universal AC input so they can be automatically operated from any AC mains input worldwide. They can be operated from line voltages of 85 – 265 VAC, 47 to 63 Hz, with no switch to set or fuses to change when you switch from one voltage standard to another. They also provide power factor correction.

## Specifications

(at 0° to 40 °C unless otherwise specified)

	N5741A	N5742A	N5743A	N5744A	N5745A	N5746A
<b>Number of Outputs</b>	1	1	1	1	1	1
<b>GPIB, LAN, USB</b>	Yes	Yes	Yes	Yes	Yes	Yes
<b>Output Ratings</b>						
Voltage	6 V	8 V	12.5 V	20 V	30 V	40 V
Current	100 A	90 A	60 A	38 A	25 A	19 A
Power	600 W	720 W	750 W	760 W	750 W	760 W
<b>Programming Accuracy</b>						
Voltage 0.05%+	3 mV	4 mV	6.25 mV	10 mV	15 mV	20 mV
Current 0.1%+	100 mA	90 mA	60 mA	38 mA	25 mA	19 mA
<b>Output Ripple and Noise</b>						
CV p-p (Up to 20 MHz)	60 mV	60 mV	60 mV	60 mV	60 mV	60 mV
CV rms (From 5 Hz – 1 MHz)	8 mV	8 mV	8 mV	8 mV	8 mV	8 mV
<b>Readback Accuracy</b>						
Voltage 0.1%+	6 mV	8 mV	12.5 mV	20 mV	30 mV	40 mV
Current 0.1%+	300 mA	270 mA	180 mA	114 mA	75 mA	57 mA
<b>Load Regulation</b> (change from 10% to 90%)						
Voltage	2.6 mV	2.8 mV	3.25 mV	4 mV	5 mV	6 mV
Current	25 mA	23 mA	17 mA	12.6 mA	10 mA	8.8 mA
<b>Line Regulation</b> (change from 85-132 VAC input or 170-265 VAC input)						
Voltage	2.6 mV	2.8 mV	3.25 mV	4 mV	5 mV	6 mV
Current	12 mA	11 mA	8 mA	5.8 mA	4.5 mA	3.9 mA
<b>Transient Response Time<sup>1</sup></b>						
Time	≤1.5 ms	≤1.5 ms	≤1.5 ms	≤1 ms	≤1 ms	≤1 ms

### Notes:

<sup>1</sup> Time for output voltage to recover within 0.5% of its rated output for a load change from 10 to 90% of its rated output current. Voltage set point from 10% to 100% of rated output

\* AC input connector: IEC 320 connector for 750 W models, and wire clamp connector for 1500 W models



Single-Output 750 W & 1500 W GPIB, LAN, USB  
(Continued)

Specifications  
(at 0° to 40° C unless  
otherwise specified)

N5741A	N5742A	N5743A	N5744A	N5745A	N5746A
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Supplemental Characteristics

(Non-warranted characteristics determined by design  
that are useful in applying the product)

<b>Output Response Time</b> (settle to within ±1.0% of the rated output, with a resistive load)						
Up, full load	0.08 s	0.08 s	0.08 s	0.08 s	0.08 s	0.08 s
Down, full load	0.05 s	0.05 s	0.05 s	0.05 s	0.08 s	0.08 s
Down, no load	0.5 s	0.6 s	0.7 s	0.8 s	0.9 s	1.0 s
<b>Remote Sense Compensation</b>						
Volts/load lead	1 V	1 V	1 V	1 V	1.5 V	2 V
<b>Output Ripple and Noise<sup>2</sup></b>						
CC rms	200 mA	180 mA	120 mA	76 mA	63 mA	48 m
<b>Programming Resolution/ Measurement Resolution</b>						
Voltage	0.72 mV	0.96 mV	1.5 mV	2.4 mV	3.6 mV	4.8 mV
Current	12 mA	10.8 mA	7.2 mA	4.56 mA	3 mA	2.3 mA

Notes:

<sup>2</sup> From 5 Hz – 1 MHz, at 10% to 100% of output voltage at full load  
(for 6 V units from 33% to 100% of output voltage)

Extensive Device Protection

To safeguard your device from damage, the N5700 Series power supplies provide over-temperature, over-current and over-voltage protect (OVP) to shut down the power supply output when a fault occurs. They also offer an undervoltage limit (UVL) that prevents adjustment of the output voltage below a certain limit. The combination of UVL and OVP capabilities lets you create a protection window for sensitive load circuitry

Simplify System Connection

The N5700 offers many system oriented features to simplify and accelerate test system development. They support the industry standard SCPI commands and come standard with software drivers.

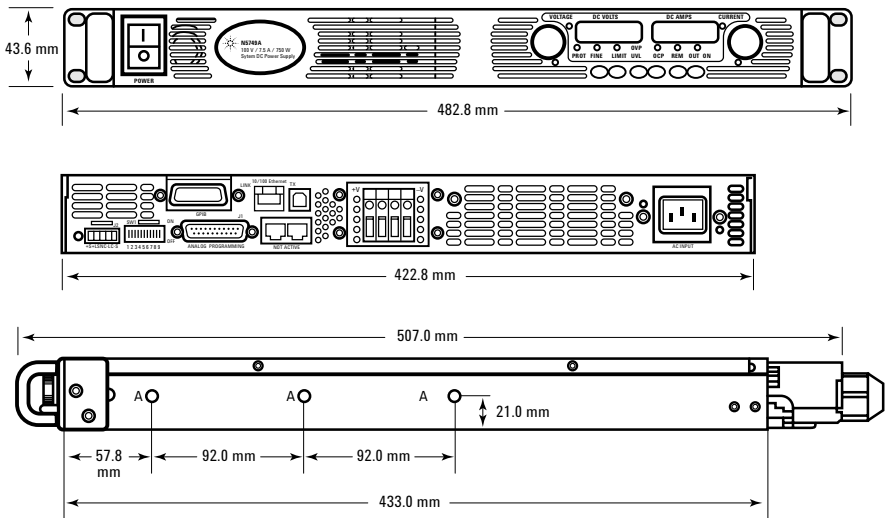
With built-in GPIB, Ethernet/LAN, and USB 2.0 interfaces, the N5700 gives you the flexibility to use your I/O interface of choice today and in the future.

Additionally, the built-in Web server lets you operate, configure, and monitor the N5700 remotely via a standard browser such as Microsoft Internet Explorer.

Command Compatibility

The N5700 includes a compatibility command set for the Xantrex XFR series power supplies, the Sorensen DLM series power supplies, and the Agilent 603x series power supplies. This simplifies system integration when converting to the N5700.

Agilent Models: N5741A - N5772A



More detailed specifications at [www.agilent.com/find/N5700](http://www.agilent.com/find/N5700)

## Single-Output 750 W & 1500 W GPIB, LAN, USB (Continued)

### Analog/Resistance Programming

For greater programming flexibility and to minimize the time associated with computer interaction, both the output voltage and current can be controlled by an external voltage or resistance programming signal.

### Connect Multiple Units in Parallel and Series

Should you need greater output power, the N5700 Series power supplies give you the flexibility to connect in parallel up to four similarly rated units for greater output current and connect two similarly rated units in series for greater output voltage (see DC float voltage information)

### Fan Speed Control

Lab bench use is enhanced by the fan speed control, which helps to minimize the acoustic noise.

### Application Notes:

**Side-by-Side Comparison:**  
**Agilent N5700 System DC Source and Sorensen DLM Power Supply**  
5989-1628EN

**Side-by-Side Comparison:**  
**Agilent N5700 System DC Source and Xantrex XFR DC Power Supply**  
5989-1630EN

**Trends in Programmable Medium Power (~1 kW) System DC Power Supplies**  
5989-1331EN

### Notes:

<sup>1</sup> Time for output voltage to recover within 0.5% of its rated output for a load change from 10 to 90% of its rated output current. Voltage set point from 10% to 100% of rated output

<sup>2</sup> From 5 Hz – 1 MHz, at 10% to 100% of output voltage at full load (for 6 V units from 33% to 100% of output voltage)

### Specifications

(at 0° to 40°C unless otherwise specified)

	N5747A	N5748A	N5749A	N5750A	N5751A	N5752A
<b>Number of Outputs</b>	1	1	1	1	1	1
<b>GPIB, LAN, USB</b>	Yes	Yes	Yes	Yes	Yes	Yes
<b>Output Ratings</b>						
Voltage	60 V	80 V	100 V	150 V	300 V	600 V
Current	12.5 A	9.5 A	7.5 A	5 A	2.5 A	1.3 A
Power	750 W	760 W	750 W	750 W	750 W	780 W
<b>Programming Accuracy</b>						
Voltage 0.05%+	30 mV	40 mV	50 mV	75 mV	150 mV	300 mV
Current 0.1%+	12.5 mA	9.5 mA	7.5 mA	5 mA	2.5 mA	1.3 mA
<b>Output Ripple and Noise</b>						
CV p-p (Up to 20 MHz)	60 mV	80 mV	80 mV	100 mV	150 mV	300 mV
CV rms (From 5 Hz – 1 MHz)	8 mV	8 mV	8 mV	12 mV	20 mV	60 mV
<b>Readback Accuracy</b>						
Voltage 0.1%+	60 mV	80 mV	100 mV	150 mV	300 mV	600 mV
Current 0.1%+	37.5 mA	28.5 mA	22.5 mA	15 mA	7.5 mA	3.9 mA
<b>Load Regulation</b> (change from 10% to 90%)						
Voltage	8 mV	10 mV	12 mV	17 mV	32 mV	62 mV
Current	7.5 mA	6.9 mA	6.5 mA	6 mA	5.5 mA	5.26 mA
<b>Line Regulation</b> (change from 85-132 VAC input or 170-265 VAC input)						
Voltage	8 mV	10 mV	12 mV	17 mV	32 mV	62 mV
Current	3.25 mA	2.95 mA	2.75 mA	2.5 mA	2.25 mA	2.13 mA
<b>Transient Response Time<sup>1</sup></b>						
Time	≤ 1 ms	≤ 1 ms	≤ 1 ms	≤ 2 ms	≤ 2 ms	≤ 2 ms

### Supplemental Characteristics

(Non-warranted characteristics determined by design that are useful in applying the product)

<b>Output Response Time</b> (settle to within ±1.0% of the rated output, with a resistive load)						
Up, full load	0.08 s	0.15 s	0.15 s	0.15 s	0.15 s	0.25 s
Down, full load	0.08 s	0.15 s	0.15 s	0.15 s	0.15 s	0.30 s
Down, no load	1.1 s	1.2 s	1.5 s	2.0 s	3.0 s	4.0 s
<b>Remote Sense Compensation</b>						
Volts/load lead	3 V	4 V	5 V	5 V	5 V	5 V
<b>Output Ripple and Noise<sup>2</sup></b>						
CC rms	38 mA	29 mA	23 mA	18 mA	13 mA	8 mA
<b>Programming Resolution/ Measurement Resolution</b>						
Voltage	7.2 mV	9.6 mV	12 mV	18 mV	36 mV	72 mV
Current	1.5 mA	1.14 mA	0.9 mA	0.6 mA	0.3 mA	0.156 mA

More detailed specifications at [www.agilent.com/find/N5700](http://www.agilent.com/find/N5700)

## Single-Output 750 W & 1500 W GPIB, LAN, USB (Continued)

### Supplemental Characteristics for all model numbers

**Command Processing Time:** Average time required for the output voltage to begin to change following receipt of digital data is 55 ms.

#### DC Floating Voltage:

##### 6 V to 60 V units

No output terminal may be more than  $\pm 60$  VDC from any other terminal or chassis ground

##### 80 V to 600 V units

No output terminal may be more than  $\pm 600$  VDC from any other terminal or chassis ground

**Modulation:** (Analog programming of output voltage and current)

**Input Signal:** selectable,  
0 to 5 V/0 to 10 V full scale

**Input Impedance:** selectable,  
0 to 5 k $\Omega$ /0 to 10 k $\Omega$  full scale

**I/O Interface:** GPIB, LAN,  
USB standard

#### Software Driver:

- IVI-COM
- LabVIEW

#### AC Input:

**Input Range:** 85 – 265 VAC; 47 – 63 Hz

**Input Current 750 W:** 10.5 A at 100 VAC nominal; 5 A at 200 VAC nominal

**Input Current 1500 W:** 21 A at 100 VAC nominal; 11 A at 200 VAC nominal

#### Notes:

<sup>1</sup> Time for output voltage to recover within 0.5% of its rated output for a load change from 10 to 90% of its rated output current. Voltage set point from 10% to 100% of rated output

<sup>2</sup> From 5 Hz – 1 MHz, at 10% to 100% of output voltage at full load (for 6 V units from 33% to 100% of output voltage)

### Specifications

(at 0° to 40°C unless  
otherwise specified)

	N5761A	N5762A	N5763A	N5764A	N5765A	N5766A
<b>Number of Outputs</b>	1	1	1	1	1	1
<b>GPIB, LAN, USB</b>	Yes	Yes	Yes	Yes	Yes	Yes
<b>Output Ratings</b>						
Voltage	6 V	8 V	12.5 V	20 V	30 V	40 V
Current	180 A	165 A	120 A	76 A	50 A	38 A
Power	1080 W	1320 W	1500 W	1520 W	1500 W	1520 W
<b>Programming Accuracy</b>						
Voltage 0.05%+	3 mV	4 mV	6.25 mV	10 mV	15 mV	20 mV
Current 0.1%+	180 mA	165 mA	120 mA	76 mA	50 mA	38 mA
<b>Output Ripple and Noise</b>						
CV p-p (Up to 20 MHz)	60 mV	60 mV	60 mV	60 mV	60 mV	60 mV
CV rms (From 5 Hz – 1 MHz)	8 mV	8 mV	8 mV	8 mV	8 mV	8 mV
<b>Readback Accuracy</b>						
Voltage 0.1%+	6 mV	8 mV	12.5 mV	20 mV	30 mV	40 mV
Current 0.1%+	540 mA	495 mA	360 mA	228 mA	150 mA	114 mA
<b>Load Regulation</b> (change from 10% to 90%)						
Voltage	2.6 mV	2.8 mV	3.25 mV	4 mV	5 mV	6 mV
Current	41 mA	38 mA	29 mA	20.2 mA	15 mA	12.6 mA
<b>Line Regulation</b> (change from 85-132 VAC input or 170-265 VAC input)						
Voltage	2.6 mV	2.8 mV	3.25 mV	4 mV	5 mV	6 mV
Current	20 mA	18.5 mA	14 mA	9.6 mA	7 mA	5.8 mA
<b>Transient Response Time<sup>1</sup></b>						
Time	$\leq 1.5$ ms	$\leq 1.5$ ms	$\leq 1.5$ ms	$\leq 1$ ms	$\leq 1$ ms	$\leq 1$ ms

### Supplemental Characteristics

(Non-warranted characteristics determined by design  
that are useful in applying the product)

#### Output Response Time

(settle to within  $\pm 1.0\%$  of the  
rated output, with a resistive load)

Up, full load	0.08 s	0.08 s	0.08 s	0.08 s	0.08 s	0.08 s
Down, full load	0.05 s	0.05 s	0.05 s	0.05 s	0.08 s	0.08 s
Down, no load	0.5 s	0.6 s	0.7 s	0.8 s	0.9 s	1.0 s

#### Remote Sense Compensation

Volts/load lead	1 V	1 V	1 V	1 V	1.5 V	2 V
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#### Output Ripple and Noise<sup>2</sup>

CC rms	360 mA	330 mA	240 mA	152 mA	125 mA	95 mA
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#### Programming Resolution/ Measurement Resolution

Voltage	0.72 mV	0.96 mV	1.5 mV	2.4 mV	3.6 mV	4.8 mV
Current	21.6 mA	19.8 mA	14.4 mA	9.12 mA	6 mA	4.6 mA

More detailed specifications at [www.agilent.com/find/N5700](http://www.agilent.com/find/N5700)

## Single-Output 750 W & 1500 W GPIB, LAN, USB (Continued)

**Power Factor:** 0.99 at nominal input and rated output power

**Regulatory Compliance:** European EMC directive 89/336/EEC for Class A products, Australian C-Tick mark, This ISM device complies with Canadian ICES-001. Cet appareil ISM est conforme à la norme NMB-001 du Canada. European Low Voltage Directive 73/23/EEC.

**Size:** 43.6 mm H x 422.8 mm W x 432.8 mm D (1.72 in x 16.65 in x 17.04 in), excluding connectors and handles

**Weight:** Net, 750 W – 7 Kg (15.4 lbs); 1500 W – 8.5 Kg (18.7 lbs)

**Warranty Period:** One year

### Ordering Information

#### For N574x and N575x (750 W Models)

- Opt 900** Power Cord, United Kingdom
- Opt 902** Power Cord, Europe
- Opt 903** Power Cord, USA, Canada
- Opt 918** Power Cord, Japan
- Opt 922** Power Cord, China

#### For N576x and N577x (1500 W Models)

- Opt 861** Underterminated Power Cord, USA, Canada, China, Japan, Other
- Opt 862** Harmonized Underterminated Power Cord, Europe

### Accessories for all N5700 Models

**N5740A** Rack Mount Slide Kit (required for rack mounting; standard system II rack mounting hardware will not work).

### Notes:

<sup>1</sup> Time for output voltage to recover within 0.5% of its rated output for a load change from 10 to 90% of its rated output current. Voltage set point from 10% to 100% of rated output

<sup>2</sup> From 5 Hz – 1 MHz, at 10% to 100% of output voltage at full load (for 6 V units from 33% to 100% of output voltage)

### Specifications

(at 0° to 40° C unless otherwise specified)

	N5767A	N5768A	N5769A	N5770A	N5771A	N5772A
<b>Number of Outputs</b>	1	1	1	1	1	1
<b>GPIB, LAN, USB</b>	Yes	Yes	Yes	Yes	Yes	Yes
<b>Output Ratings</b>						
Voltage	60 V	80 V	100 V	150 V	300 V	600 V
Current	25 A	19 A	15 A	10 A	5 A	2.6 A
Power	1500 W	1520 W	1500 W	1500 W	1500 W	1560 W
<b>Programming Accuracy</b>						
Voltage 0.05%+	30 mV	40 mV	50 mV	75 mV	150 mV	300 mV
Current 0.1%+	25 mA	19 mA	15 mA	10 mA	5 mA	2.6 mA
<b>Output Ripple and Noise</b>						
CV p-p (Up to 20 MHz)	60 mV	80 mV	80 mV	100 mV	150 mV	300 mV
CV rms (From 5 Hz – 1 MHz)	8 mV	8 mV	8 mV	12 mV	20 mV	60 mV
<b>Readback Accuracy</b>						
Voltage 0.1%+	60 mV	80 mV	100 mV	150 mV	300 mV	600 mV
Current 0.1%+	75 mA	57 mA	45 mA	30 mA	15 mA	7.8 mA
<b>Load Regulation</b> (change from 10% to 90%)						
Voltage	8 mV	10 mV	12 mV	17 mV	32 mV	62 mV
Current	10 mA	8.8 mA	8 mA	7 mA	6 mA	5.5 mA
<b>Line Regulation</b> (change from 85-132 VAC input or 170-265 VAC input)						
Voltage	8 mV	10 mV	12 mV	17 mV	32 mV	62 mV
Current	4.5 mA	3.9 mA	3.5 mA	3 mA	2.5 mA	2.26 mA
<b>Transient Response Time<sup>1</sup></b>						
Time	≤ 1 ms	≤ 1 ms	≤ 1 ms	≤ 2 ms	≤ 2 ms	≤ 2 ms

### Supplemental Characteristics

(Non-warranted characteristics determined by design and useful in applying the product)

<b>Output Response Time</b> (settle to within ±1.0% of the rated output, with a resistive load)						
Up, full load	0.08 s	0.15 s	0.15 s	0.15 s	0.15 s	0.25 s
Down, full load	0.08 s	0.15 s	0.15 s	0.15 s	0.15 s	0.30 s
Down, no load	1.1 s	1.2 s	1.5 s	2.0 s	3.0 s	4.0 s
<b>Remote Sense Compensation</b>						
Volts/load lead	3 V	4 V	5 V	5 V	5 V	5 V
<b>Output Ripple and Noise<sup>2</sup></b>						
CC rms	75 mA	57 mA	45 mA	35 mA	25 mA	12 mA
<b>Programming Resolution/ Measurement Resolution</b>						
Voltage	7.2 mV	9.6 mV	12 mV	18 mV	36 mV	72 mV
Current	3 mA	2.28 mA	1.8 mA	1.2 mA	0.6 mA	0.312 mA

More detailed specifications at [www.agilent.com/find/N5700](http://www.agilent.com/find/N5700)

# High Performance DC Power Supplies...

speed and accuracy  
for test optimization

Agilent Performance DC Power Supplies provide the features and performance necessary to satisfy the most demanding requirements. For system designers who are striving to shorten test time and maximize production throughput, the Agilent High Performance DC power supplies will help them achieve their goals.

Multiple output power supplies reduce rack space. The advanced programmable capabilities allow for efficient system design and maintenance. Also their programming and measurement accuracy, and their DUT protection features, make them an excellent value for the R&D lab.

Comparison Summary	Agilent Basic DC Power Supplies	Agilent High Performance DC Power Supplies
Output Power	30 W-1500 W	40 W-6600 W
Number of outputs	1-3	1-8
GPIO programming and measurement speed	Moderate	Fast
Output rise/fall time	Moderate	Fast
Convenient 1/2 rack-size for bench-top use	Yes	No
Active Downprogrammer for enhanced test throughput	No	Yes
Stored wake-up state	No	Yes
Programmable Capabilities	Moderate	Extensive
Protection for the DUT	Moderate	Extensive

More detailed specifications at [www.agilent.com/find/power](http://www.agilent.com/find/power)



6611C - 6614C

## Single-Output 40-50 W GPIB

Small, compact size for bench and system use

Fast, low-noise outputs

Dual-range, precision low current measurement

Built-in measurements and advanced programmable features

Protection features to ensure DUT safety

This series of linear-regulated 40-50 W DC power supplies is designed to maximize the throughput of DUTs through the manufacturing test process with fast programming and measurement, and also active downprogramming. It offers many advanced programmable features including stored states and status reporting. Programming is done using industry standard SCPI commands via the GPIB or RS-232. Test system integration is further simplified by using the *VXIPlug&Play* drivers. The optional relays simplify system design and troubleshooting.

The half-rack size of the 6610A series makes it a convenient DC power supply for the R&D lab bench. The built-in microamp measurement system helps the engineer to easily and accurately monitor the output voltage and current without a complicated test setup.

### Application Notes:

**10 Practical Tips You Need to Know About Your Power Products**  
5965-8239E

**10 Hints for Using Your Power Supply to Decrease Test Time**  
5968-6359E

**Understanding Linear Power Supply Operation (AN1554)**  
5989-2291EN

### Specifications

(at 0° to 55°C unless otherwise specified)

Specifications (at 0° to 55°C unless otherwise specified)	6611C	6612C	6613C	6614C	6611C- J05 Special Order Option	
Number of outputs	1	1	1	1	1	
GPIB	Yes	Yes	Yes	Yes	Yes	
Output Ratings						
Voltage	0 to 8 V	0 to 20 V	0 to 50 V	0 to 100 V	0 to 10 V	
Current	0 to 5 A	0 to 2 A	0 to 1 A	0 to 0.5 A	0 to 5 A	
Programming accuracy (at 25°C ±5°C)						
Voltage	5 m V	10 m V	20 m V	50 m V	5 m V	
+Current	0.05% +	2 m A	1 m A	0.75 m A	0.5 m A	2 m A
Ripple and noise 20 Hz to 20 MHz, with outputs ungrounded or with either terminal grounded						
Voltage	rms peak -to-peak	0.5 mV 3 mV	0.5 mV 3 mV	0.5 mV 4 mV	0.5 mV 5 mV	0.5 mV 3 mV
Normal mode	rms	2 mA	1 mA	1 mA	1 mA	2 mA
DC measurement accuracy via GPIB or front-panel meters with respect to actual output at 25°C ±5°C						
Voltage	0.03% +	2 mV	3 mV	6 mV	12 mV	2 mV
Low current range -20 mA to +20 mA	0.1% +	2.5 µA	2.5 µA	2.5 µA	2.5 µA	2.5 µA
High current range +20 mA to +rated 1 -20 mA to - rated 1	0.2% + 0.2% +	0.5 mA 1.1 mA	0.25 mA 0.85 mA	0.2 mA 0.8 mA	0.1 mA 0.7 mA	0.5 mA 1.1 mA
Load regulation						
Voltage		2 mV	2 mV	4 mV	5 mV	2 mV
Current		1 mA	0.5 mA	0.5 mA	0.5 mA	1 mA
Line regulation						
Voltage		0.5 mV	0.5 mV	1 mV	1 mV	0.5 mV
Current		0.5 mA	0.5 mA	0.25 mA	0.25 mA	0.5 mA
Transient response time Less than 100 µs for the output to recover to its previous level (within 0.1% of the voltage rating of the supply or 20 mV, whichever is greater) following any step change in load current of up to 50% of the output current rating of the supply						
Supplemental Characteristics	(Non-warranted characteristics determined by design and useful in applying the product)					
Average programming resolution						
Voltage		2 mV	5 mV	12.5 mV	25 mV	3 mV
Current		1.25 mA	0.5 mA	0.25 mA	0.125 mA	1.25 mA
Sink current		3 A	1.2 A	0.6 A	0.3 A	3 A

More detailed specifications at [www.agilent.com/find/6610](http://www.agilent.com/find/6610)

## Single-Output: 40-50 W GPIB (Continued)

### Supplemental Characteristics for all model numbers

**DC Floating Voltage:** Output terminals can be floated up to  $\pm 240$  Vdc maximum from chassis ground

**Remote Sensing:** Up to two volts dropped in each load lead. Add 2 mV to the voltage load regulation specification for each one volt change in the positive output lead due to load current change.

**Command Processing Time:** Average time required for the output voltage to begin to change following receipt of digital data is 4 ms for the power supplies connected directly to the GPIB.

**Output Programming Response Time:** The rise and fall time (10/90% and 90/10%) of the output voltage is less than 2 ms. The output voltage change settles within 1 LSB (0.025% x rated voltage) of final value in less than 6 ms.

**GPIB Interface Capabilities:** IEEE-488.2, SCPI command set, and 6630A Series programming compatibility

**Input Power:** (full load): 1.6 A, 100 W (6611C: 2.2 A, 120 W)

**Regulatory Compliance:** Complies with EMC directive 89/336/EEC (ISM 1B).

**Software Driver:**  
VXIPlug&Play

**Warranty Period:** One year

**Size:** 212.8 mm W x 88.1 mm H x 368.3 mm D (8.4 in x 3.5 in x 14.5 in)

**Weight:** 8.2 kg (18.16 lb) net;  
10.6 kg (23.5 lb) shipping

### Ordering Information

**Opt 100** 87 to 106 Vac, 47 to 63 Hz

**Opt 120** 104 to 127 Vac, 47 to 63 Hz

**Opt 220** 191 to 233 Vac, 47 to 63 Hz

**Opt 230** 207 to 253 Vac, 47 to 63 Hz

**Opt 760** Isolation and Reversal relays

\* **Opt ICM** Rack-mount Kit  
(p/n 5063-9240)

\* **Opt AXS** Rack-mount Kit  
side-by-side mounting of two units,  
Lock-link Kit p/n 5061-9694;  
Flange Kit p/n 5062-3974

**Opt 0L1** Full documentation on  
CD-ROM, and printed standard  
documentation package

**Opt 0L2** Extra copy of standard  
printed documentation package

**Opt 0B0** Full documentation on  
CD-ROM only

**Opt 0B3** Service Manual

\*Support rails required

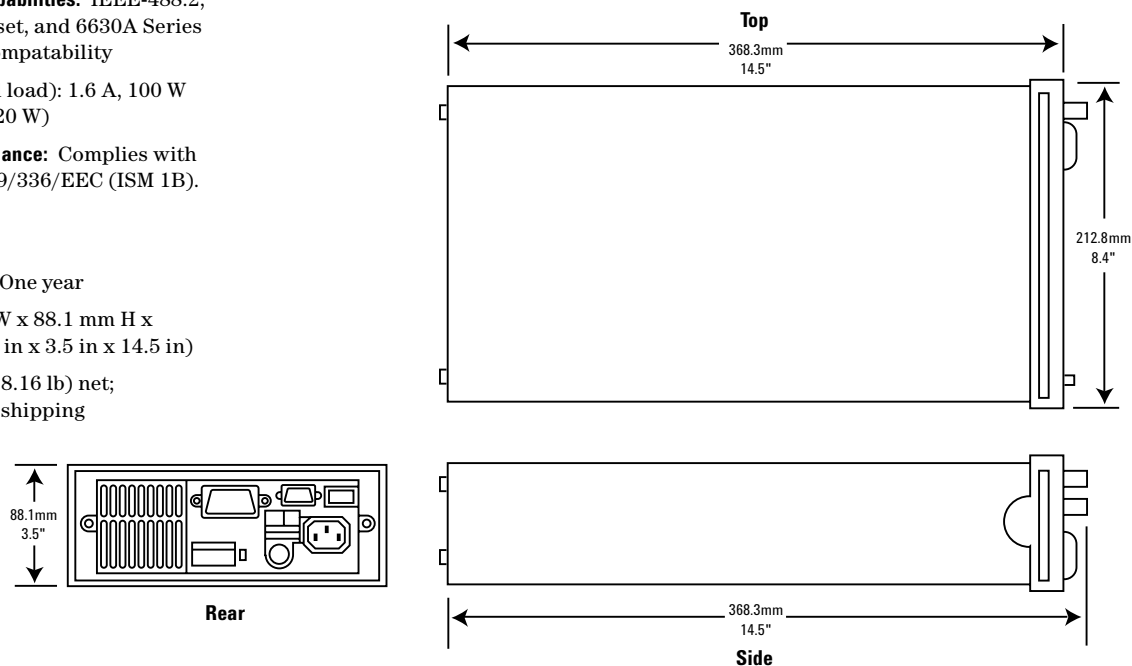
### Accessories

Rack-mount and slide for two  
side-by-side units of different lengths  
p/n 1494-0015, 5063-9255 and filler  
panel 5002-3999

Rack-mount slide and support for one  
instrument p/n 1494-0015, 5063-9255  
and filler panel 5002-3999

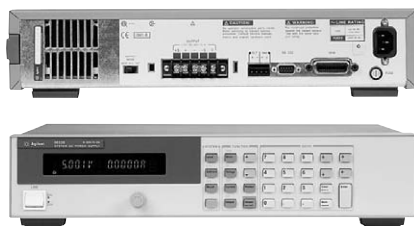
**E3663AC** Support rails for Agilent rack  
cabinets

**Agilent Models: 6611C, 6612C, 6613C, 6614C**



More detailed specifications at [www.agilent.com/find/6610](http://www.agilent.com/find/6610)

# Single-Output 80-100 W GPIB



6631B - 6634B

Fast, low-noise outputs

Programmable active down-programmer sinks the full rated current

Dual-range, precision low current measurement

Optional isolation and polarity reversal relays

Built-in measurements and advanced programmable features

Protection features to ensure DUT safety

This series of linear-regulated 80-100 W DC power supplies is designed to maximize the throughput of DUTs through the manufacturing test process. Both programming and measurement are optimized for speed. The active downprogrammer can sink up to the full rated current of the power supply, which quickly brings the power supply output to zero volts. The 6630B Series offers many advanced programmable features including stored states and status reporting. Programming is done using industry standard SCPI commands via the GPIB or RS-232. Test system integration is further simplified by using the *VXIPlug&Play* drivers. The optional relays simplify system design and troubleshooting.

The optional front panel binding posts make the 6630B Series convenient on the R&D lab bench. The built-in microamp measurement system helps the engineer to easily and accurately monitor the output voltage and current without a complicated test setup.

## Application Notes:

**10 Practical Tips You Need to Know About Your Power Products**  
5965-8239E

**10 Hints for Using Your Power Supply to Decrease Test Time**  
5968-6359E

## Specifications

(at 0° to 55°C unless otherwise specified)

	6631B	6632B	6633B	6634B
<b>Number of outputs</b>	1	1	1	1
<b>GPIB</b>	Yes	Yes	Yes	Yes
<b>Output ratings</b>				
Voltage	0 to 8 V	0 to 20 V	0 to 50 V	0 to 100 V
Current	0 to 10 A	0 to 5 A	0 to 2 A	0 to 1 A
<b>Programming accuracy at 25°C ±5°C</b>				
Voltage	5 mV	10 mV	20 mV	50 mV
+ Current	0.05% + 4 mA	2 mA	1 mA	0.5 mA
<b>Ripple and noise</b> (20 Hz to 20 MHz, with outputs ungrounded or with either terminal grounded)				
Voltage Normal mode	rms 0.3 mV peak-to-peak 3 mV	rms 0.3 mV peak-to-peak 3 mV	rms 0.5 mV peak-to-peak 3 mV	rms 0.5 mV peak-to-peak 3 mV
Fast mode	rms 1 mV peak-to-peak 10 mV	rms 1 mV peak-to-peak 10 mV	rms 1 mV peak-to-peak 15 mV	rms 2 mV peak-to-peak 25 mV
Current	rms 3 mA	2 mA	2 mA	2 mA
<b>DC measurement accuracy</b> via GPIB or front panel meters with respect to actual output at 25°C ±5°C				
Voltage	0.03% + 2 mV	3 mV	6 mV	12 mV
Low current range	–20 mA to +20 mA 0.1% + 2.5 µA	2.5 µA	2.5 µA	2.5 µA
High current range	+20 mA to +rated I 0.2% + –20 mA to –rated I 0.2% + 1.6 mA	0.5 mA 1.1 mA	0.25 mA 0.85 mA	0.25 mA 0.85 mA
<b>Load regulation</b>				
Voltage	2 mV	2 mV	4 mV	5 mV
Current	2 mA	1 mA	1 mA	1 mA
<b>Line regulation</b>				
Voltage	0.5 mV	0.5 mV	1 mV	1 mV
Current	1 mA	0.5 mA	0.25 mA	0.25 mA
<b>Transient response time</b>	Less than 100 µs (50 µs in the fast mode) for the output voltage to recover to its previous level (within 0.1% of the voltage rating of the supply or 20 mV) following any step change in load current of up to 50% of the output current rating of the supply.			

## Understanding Linear Power Supply

**Operation** (AN1554)  
5989-2291EN

More detailed specifications at [www.agilent.com/find/6630](http://www.agilent.com/find/6630)



## Single-Output: 80-100 W GPIB (Continued)

## Specifications

(at 0° to 55°C unless otherwise specified)

6631B

6632B

6633B

6634B

Supplemental Characteristics  
for all model numbers

**DC Floating Voltage:** Output terminals can be floated up to  $\pm 240$  Vdc maximum from chassis ground

**Remote Sensing:** Up to two volts dropped in each load lead. Add 2 mV to the voltage load regulation specification for each one volt change in the positive output lead due to load current change.

**Command-Processing Time:** Average time required for the output voltage to begin to change following receipt of digital data is 4 ms for the power supplies connected directly to the GPIB. (Display disabled).

**Output-Programming Response Time:** The rise and fall time (10/90% and 90/10%) of the output voltage is less than 2 ms (400  $\mu$ s in fast mode). The output voltage change settles within 1 LSB (0.025% x rated voltage) of final value in less than 6 ms (2 ms in the fast mode).

**GPIB Interface Capabilities:** IEEE-488.2, SCPI command set and 6630A Series programming compatibility

**Software Driver:**  
VXIPlug&Play

**Measurement Time:** Average time to make a voltage or current measurement is 50 ms.

**Input Power (full load):** 3.5 A, 250 W

**Regulatory Compliance:** Complies with EMC directive 89/336/EEC (ISM 1B).

**Warranty Period:** One year

**Size:** 425.5 mm W x 88.1 mm H x 364.4 mm D (16.8 in x 3.5 in x 14.3 in).

**Weight:** Net, 12.7 kg (28 lb) net;  
15.0 kg (33 lb) shipping

## Supplemental Characteristics

(Non-warranted characteristics determined by design and useful in applying the product)

Average programming resolution				
Voltage	2 mV	5 mV	12.5 mV	25 mV
Current	2.5 mA	1.25 mA	0.5 mA	0.25 mA
Sink current	10 A	5 A	2 A	1 A
Sink current tracking				
SCPI mode	0.4% + 4 mA	0.4% + 2 mA	0.4% + 1 mA	0.4% + 0.5 mA
Compatibility mode	-500 mA	-250 mA	-100 mA	-50 mA
Minimum current in constant current mode*				
	40 mA	20 mA	8 mA	4 mA

\*When programming in the 6630A Series language compatibility mode.

## Ordering Information

**Opt 100** 87 to 106 Vac, 47 to 63 Hz

**Opt 120** 104 to 127 Vac, 47 to 63 Hz

**Opt 220** 191 to 233 Vac, 47 to 63 Hz

**Opt 230** 207 to 253 Vac, 47 to 63 Hz

**Opt 020** Front-panel Binding Posts  
(N/A on 6631B)

**Opt 760** Isolation and Reversal Relays,  
only available at time of order  
(N/A on 6631B)

\* **Opt 1CM** Rack-mount Kit,  
p/n 5063-9212

\* **Opt 1CP** Rack-mount Kit with Handles,  
p/n 5063-9219

**Opt 0L1** Full documentation on  
CD-ROM, and printed standard  
documentation package

**Opt 0L2** Extra copy of standard  
printed documentation package

**Opt 0B0** Full documentation on  
CD-ROM only

**Opt 0B3** Service Manual

\* Support rails required

## Accessories

p/n 1494-0060 Rack Slide Kit

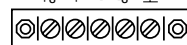
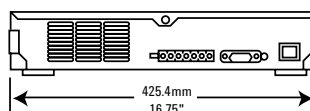
**E3663AC** Support rails for Agilent  
rack cabinets

## Agilent Models: 6631B, 6632B, 6633B, 6634B

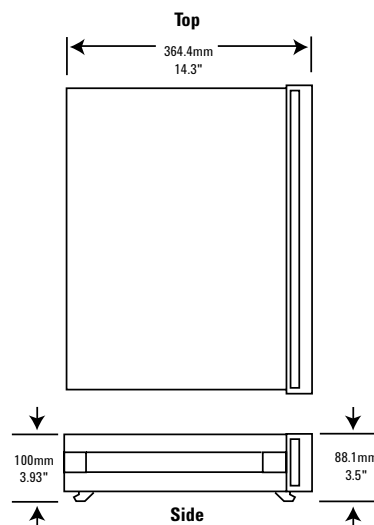
## Terminal Strip Detail

## Output 2 &amp; 3

+S + - S +

Screw Size:  
M35 x 0.6

Rear

More detailed specifications at [www.agilent.com/find/6630](http://www.agilent.com/find/6630)



6641A - 6645A

## Single-Output 200 W GPIB

Fast, low-noise outputs

Analog control of output voltage and current

Fan-speed control to minimize acoustic noise

Parallel and series connections of multiple units

Built-in measurements and advanced programmable features

Protection features to ensure DUT safety

This series of 200 W linear-regulated DC power supplies is designed to maximize the throughput of DUTs through the manufacturing test process with fast up and down programming time.

Valuable assemblies can be destroyed by a minor component failure that can allow a surge of voltage or current to flow to the DUT. Fast protection features, including fast crowbar, mode crossover protection, and the ability to connect the protection circuitry of multiple power supplies can increase production yield.

Programming of the DC output and the protection features can be done either from the front panel or using industry standard SCPI commands, via the GPIB. Using the serial link, up to 16 power supplies can be connected through one GPIB address. Test system integration can be further simplified by using the *VXIPlug&Play* drivers. The output voltage and current can also be controlled with analog signals. This is helpful for certain types of noisy environments, and also immediate reactions to process changes.

Lab bench use is enhanced by the fan speed control, which helps to minimize the acoustic noise.

### Specifications

(at 0° to 55° C unless  
otherwise specified)

	6641A	6642A	6643A	6644A	6645A
<b>Number of outputs</b>	1	1	1	1	1
<b>GPIB</b>	Yes	Yes	Yes	Yes	Yes
<b>Output ratings</b>					
Output voltage	0 to 8 V	0 to 20 V	0 to 35 V	0 to 60 V	0 to 120 V
Output current (40° C)	0 to 20 A	0 to 10 A	0 to 6 A	0 to 3.5 A	0 to 1.5 A
Maximum current (50° C/55° C)	18 A/17 A	9 A/8.5 A	5.4 A/5.1 A	3.2 A/3 A	1.4 A/1.3 A
<b>Programming accuracy at 25°C ±5°C</b>					
Voltage	0.06% + 5 mV	10 mV	15 mV	26 mV	51 mV
Current	0.15% + 26 mA	13 mA	6.7 mA	4.1 mA	1.7 mA
<b>Ripple and noise from 20 Hz to 20 MHz</b>					
Voltage rms	300 µV	300 µV	400 µV	500 µV	700 µV
peak-peak	3 mV	3 mV	4 mV	5 mV	7 mV
Current rms	10 mA	5 mA	3 mA	1.5 mA	1 mA
<b>Readback accuracy at 25°C ±5°C (percent of reading plus fixed)</b>					
Voltage	0.07% + 6 mV	15 mV	25 mV	40 mV	80 mV
+Current	0.15% + 18 mA	9.1 mA	5 mA	3 mA	1.3 mA
-Current	0.35% + 40 mA	20 mA	12 mA	6.8 mA	2.9 mA
<b>Load regulation</b>					
Voltage	1 mV	2 mV	3 mV	4 mV	5 mV
Current	1 mA	0.5 mA	0.25 mA	0.25 mA	0.25 mA
<b>Line regulation</b>					
Voltage	0.5 mV	0.5 mV	1 mV	1 mV	2 mV
Current	1 mA	0.5 mA	0.25 mA	0.25 mA	0.25 mA
<b>Transient response time</b>	Less than 100 µs for the output voltage to recover to its previous level (within 0.1% of the voltage rating of the supply or 20 mV, whichever is greater) following any step change in load current of up to 50% of rated current				
<b>Supplemental Characteristics</b>	(Non-warranted characteristics determined by design and useful in applying the product)				
<b>Average resolution</b>					
Voltage	2 mV	5 mV	10 mV	15 mV	30 mV
Current	6 mA	3 mA	2 mA	1.2 mA	0.5 mA
OVP	13 mV	30 mV	54 mV	93 mV	190 mV
<b>OVP accuracy</b>	160 mV	400 mV	700 mV	1.2 V	2.4 V

More detailed specifications at [www.agilent.com/find/6640](http://www.agilent.com/find/6640)

## Single-Output: 200 W GPIB (Continued)

## Application Notes:

**10 Practical Tips You Need to Know About Your Power Products**  
5965-8239E

**10 Hints for Using Your Power Supply to Decrease Test Time**  
5968-6359E

**Understanding Linear Power Supply Operation (AN1554)**  
5989-2291EN

**Modern Connectivity - Using USB and LAN I/O Converters (AN 1475-1)**  
5989-0123EN

## Supplemental Characteristics for all model numbers

**DC Floating Voltage:** Output terminals can be floated up to  $\pm 240$  Vdc from chassis ground

**Remote Sensing:** Up to half the rated output voltage can be dropped in each load lead. The drop in the load leads subtracts from the voltage available for the load.

**Command Processing Time:** Average time required for the output voltage to begin to change following receipt of digital data is 20 ms for the power supplies connected directly to the GPIB

**Output Programming Response Time:** The rise and fall time (10/90% and 90/10%) of the output voltage is less than 15 ms. The output voltage change settles within 1 LSB (0.025% x rated voltage) of final value in less than 60 ms.

**Down Programming:** An active down programmer sinks approximately 20% of the rated output current

**Modulation:** (Analog programming of output voltage and current)  
Input Signal: 0 to -5 V  
Input Impedance: 10 k Ohm nominal

## Specifications

(at 0° to 55°C unless otherwise specified)

	6641A-J04 Special Order Option	6643A-J11 Special Order Option	6644A-J09 Special Order Option	6645A-J05 Special Order Option	6645A-J06 Special Order Option
<b>Number of Outputs</b>	1	1	1	1	1
<b>GPIB</b>	Yes	Yes	Yes	Yes	Yes
<b>Output ratings</b>					
Output voltage	13 V	40 V	70 V	150 V	170 V
Output current (40°C)	15.3 A	5 A	3 A	1.2 A	1 A
Maximum current (50°C/55°C)	13.77 A/13 A	4.5 A/4.25 A	2.7 A/2.55 A	1.08 A/1.02 A	0.9 A/0.85 A
<b>Programming accuracy at 25°C <math>\pm 5^\circ\text{C}</math></b>					
Voltage 0.06% +	8.5 mV	17.5 mV	31 mV	65 mV	74 mV
Current 0.15% +	21 mA	6.7 mA	4.1 mA	1.7 mA	1.7 mA
<b>Ripple and noise</b>					
from 20 Hz to 20 MHz					
Voltage rms	300 $\mu\text{V}$	450 $\mu\text{V}$	600 $\mu\text{V}$	900 $\mu\text{V}$	1 mV
peak-peak	3 mV	3.5 mV	6 mV	9 mV	10 mV
Current rms	8 mA	3 mA	1.5 mA	1 mA	1 mA
<b>Readback accuracy at 25°C <math>\pm 5^\circ\text{C}</math> (percent of reading plus fixed)</b>					
Voltage 0.07% +	10 mV	30 mV	47 mV	100 mV	140 mV
+Current 0.15% +	15 mA	5 mA	3 mA	1.3 mA	1.3 mA
-Current 0.35% +	40 mA	12 mA	6.8 mA	2.9 mA	2.9 mA
<b>Load regulation</b>					
Voltage	1 mV	3 mV	4.5 mV	7 mV	8 mV
Current	1 mA	0.25 mA	0.25 mA	0.25 mA	0.25 mA
<b>Line regulation</b>					
Voltage	0.5 mV	1 mV	1.5 mV	2.5 mV	3 mV
Current	1 mA	0.25 mA	0.25 mA	0.25 mA	0.25 mA
<b>Transient response time</b> Less than 100 $\mu\text{s}$ for the output voltage to recover to its previous level (within 0.1% of the voltage rating of the supply or 20 mV, whichever is greater) following any step change in load current of up to 50% of rated current					
<b>Supplemental Characteristics</b>	(Non-warranted characteristics determined by design and useful in applying the product)				
<b>Average resolution</b>					
Voltage	3.5 mV	12 mV	1.4 mV	37.5 mV	42.5 mV
Current	5 mA	2 mA	1.2 mA	0.5 mA	0.5 mA
OVP	23 mV	62 mV	110 mV	250 mV	285 mV
<b>OVP accuracy</b>	260 mV	800 mV	1.5 mV	3 V	3.4 V

## Single-Output: 200 W GPIB (Continued)

**AC Input:** (AC input frequency 47 to 63 Hz)

**Voltage** 100 Vac 120 Vac 220 Vac 240 Vac

**Current** 4.4 A 3.8 A 2.2 A 2.0 A

**Input Power** 480 VA, 400 W at full load;  
60 W at no load

**GPIB Interface Capabilities** SH1, AH1, T6,  
L4, SR1, RL1, PP0, DC1, DT1, E1, and C0.  
IEEE-488.2 and SCPI-compatible com-  
mand set

**Software Driver:**

- IVI-COM
- VXIPlug&Play

**Regulatory Compliance:** Complies  
with UL 3111-1, IEC 61010-1.

**Size:** 425.5 mm W x 88.1 mm H x  
439 mm D (16.75 in x 3.5 in x 17.3 in)

**Weight:** Net, 14.2 kg (31.4 lb); shipping,  
16.3 kg (36 lb)

**Warranty Period:** One year

### Ordering Information

**Opt 100** 87 to 106 Vac, 47 to 63 Hz

**Opt 120** 104 to 127 Vac, 47 to 63 Hz

**Opt 220** 191 to 233 Vac, 47 to 63 Hz

**Opt 240** 209 to 250 Vac, 47 to 63 Hz

\* **Opt 908** Rack-mount Kit (p/n 5063-9212)

\* **Opt 909** Rack-mount Kit w/ Handles  
(p/n 5063-9219)

\* **Opt 1CP** Rack-mount Kit with Handles,  
p/n 5063-9219

**Opt 0L1** Full documentation on  
CD-ROM, and printed standard  
documentation package

**Opt 0L2** Extra copy of standard  
printed documentation package

**Opt 0B0** Full documentation on  
CD-ROM only

**Opt 0B3** Service Manual

\* Support rails required

### Accessories

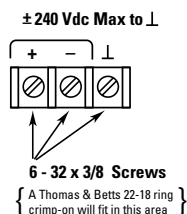
p/n **1494-0060** Accessory Slide Kit

p/n **1252-3698** 7-pin Analog Plug

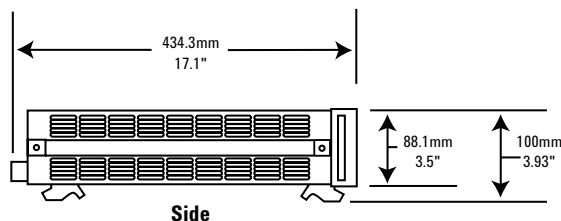
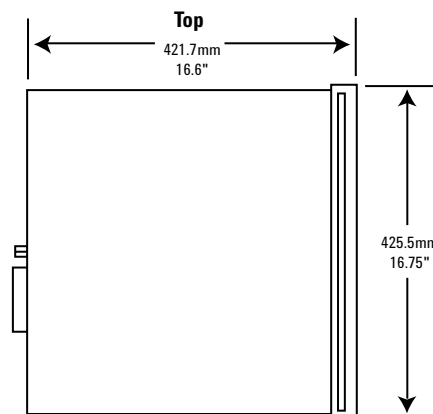
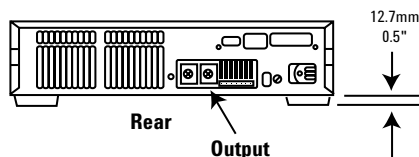
p/n **1252-1488** 4-pin Digital Plug

p/n **5080-2148** Serial Link Cable  
2 m (6.6 ft)

**E3663AC** Support rails for Agilent  
rack cabinets



Terminal Screw Size: m4 x 0.7 x 8mm



More detailed specifications at [www.agilent.com/find/6640](http://www.agilent.com/find/6640)

# Single-Output 200 W



6541A-6545A

Front panel and analog control of output voltage and current

Fast, low-noise outputs

Fan-speed control to minimize acoustic noise

Protection features to ensure DUT safety

This reliable series of 200 W DC power supplies can be controlled either from the front panel or via an analog programming voltage. When used in a test system, the fast up and down programming helps decrease test time. Quickly reacting protection features, including fast crowbar, CV/CC mode crossover and over-voltage protection help protect your valuable assemblies from damage. The linear topology produces very low ripple and noise, which allows you to make extremely accurate measurements of the devices which you are testing.

Lab bench use is enhanced by the fan speed control, which helps to minimize the acoustic noise.

## Specifications

(at 0° to 55° C unless otherwise specified)

	6541A	6542A	6543A	6544A	6545A
<b>Number of outputs</b>	1	1	1	1	1
<b>GPIO</b>	No	No	No	No	No
<b>Output ratings</b>					
Output voltage	0 to 8 V	0 to 20 V	0 to 35 V	0 to 60 V	0 to 120 V
Output current (40° C)	0 to 20 A	0 to 10 A	0 to 6 A	0 to 3.5 A	0 to 1.5 A
Maximum current (50° C/55° C)	18 A/17 A	9 A/8.5 A	5.4 A/5.1 A	3.2 A/3 A	1.4 A/1.3 A
<b>Programming accuracy</b> at 25° C ±5° C					
Voltage 0.06% +	5 mV	10 mV	15 mV	26 mV	51 mV
Current 0.14% +	26 mA	13 mA	6.7 mA	4.1 mA	1.7 mA
<b>Ripple and noise</b>					
from 20 Hz to 20 MHz					
Voltage rms	300 µV	300 µV	400 µV	500 µV	700 µV
peak-peak	3 mV	3 mV	4 mV	5 mV	7 mV
Current rms	10 mA	5 mA	3 mA	1.5 mA	1 mA
<b>Load regulation</b>					
Voltage	1 mV	2 mV	3 mV	4 mV	5 mV
Current	1 mA	0.5 mA	0.25 mA	0.25 mA	0.25 mA
<b>Line regulation</b>					
Voltage	0.5 mV	0.5 mV	1 mV	1mV	2 mV
Current	1 mA	0.5 mA	0.25 mA	0.25 mA	0.25 mA
<b>Transient response time</b>	Less than 100 µs for the output voltage to recover to its previous level (within 0.1% of the voltage rating of the supply or 20 mV, whichever is greater) following any step change in load current of up to 50% of rated current				
<b>Supplemental Characteristics</b>	(Non-warranted characteristics determined by design and useful in applying the product)				
<b>Average resolution</b>					
Voltage	2 mV	5 mV	10 mV	15 mV	30 mV
Current	6 mA	3 mA	2 mA	1.2 mA	0.5 mA
OVP	13 mV	30 mV	54 mV	93 mV	190 mV
<b>OVP accuracy</b>	160 mV	400 mV	700 mV	1.2 V	2.4 V

## Single-Output: 200 W (Continued)

**Application Notes:**

**10 Practical Tips You Need to Know About Your Power Products**  
5965-8239E

**Understanding Linear Power Supply Operation** (AN1554)  
5989-2291EN

**Supplemental Characteristics for all model numbers**

**DC Floating Voltage:** Output terminals can be floated up to  $\pm 240$  Vdc from chassis ground

**Remote Sensing:** Up to half the rated output voltage can be dropped in each load lead. The drop in the load leads subtracts from the voltage available for the load.

**Output Programming Response Time:** The rise and fall time (10/90% and 90/10%) of the output voltage is less than 15 ms. The output voltage change settles within 1 LSB (0.025% x rated voltage) of final value in less than 60 ms.

**Down Programming:** An active down programmer sinks approximately 20% of the rated output current

**Modulation:** (Analog programming of output voltage and current)  
Input Signal: 0 to -5 V  
Input Impedance: 10 k Ohm nominal

**AC Input:** (AC input frequency 47 to 63 Hz)

**Voltage** 100 Vac 120 Vac 220 Vac 240 Vac

**Current** 4.4 A 3.8 A 2.2 A 2.0 A

**Input Power:** 480 VA, 400 W at full load;  
60 W at no load

**Regulatory Compliance:** Conforms to  
UL1244 and IEC 61010-1.

**Size:** 425.5 mm W x 88.1 mm H x  
439 mm D (16.75 in x 3.5 in x 17.3 in)

**Weight:** Net, 14.2 kg (31.4 lb); shipping,  
16.3 kg (36 lb)

**Warranty Period:** One year

**Specifications**

(at 0° to 55°C unless  
otherwise specified)

**6541A-J04**

Special Order  
Option

**6544A-J09**

Special Order  
Option

**6545A-J05**

Special Order  
Option

**Number of outputs**

1

1

1

**GPIO**

No

No

No

**Output ratings****Output voltage**

13 V

70 V

150 V

**Output current (40° C)**

15.3 A

3 A

1.2 A

**Maximum current (50° C/55° C)**

13.77 A/13 A

2.7 A/2.55 A

1.08 A/1.02 A

**Programming accuracy at 25°C  $\pm 5^\circ$  C****Voltage**

0.06% +

8.5 mV

31 mV

65 mV

**Current**

0.15% +

21 mA

4.1 mA

1.7 mA

**Ripple and noise****from 20 Hz to 20 MHz****Voltage rms**300  $\mu$ V600  $\mu$ V900  $\mu$ V**peak-peak**

3 mV

6 mV

9 mV

**Current rms**

8 mA

1.5 mA

1 mA

**Load regulation****Voltage**

1 mV

4.5 mV

7 mV

**Current**

1 mA

0.25 mA

0.25 mA

**Line regulation****Voltage**

0.5 mV

1.5 mV

2.5 mV

**Current**

1 mA

0.25 mA

0.25 mA

**Transient response time**

Less than 100  $\mu$ s for the output voltage to recover to its previous level (within 0.1% of the voltage rating of the supply or 20 mV, whichever is greater) following any step change in load current of up to 50% of rated current

**Supplemental Characteristics**

(Non-warranted characteristics determined by design and useful in applying the product)

**Average resolution****Voltage**

3.5 mV

1.4 mV

37.5 mV

**Current**

5 mA

1.2 mA

0.5 mA

**OVP**

23 mV

110 mV

250 mV

**OVP accuracy**

260 mV

1.5 mV

3 V

## Single-Output: 200 W (Continued)

### Ordering Information

**Opt 100** 87 to 106 Vac, 47 to 63 Hz

**Opt 120** 104 to 127 Vac, 47 to 63 Hz

**Opt 220** 191 to 233 Vac, 47 to 63 Hz

**Opt 240** 209 to 250 Vac, 47 to 63 Hz

\* **Opt 908** Rack-mount Kit (p/n 5063-9212)

\* **Opt 909** Rack-mount Kit w/ Handles  
(p/n 5063-9219)

**Opt 0L1** Full documentation on  
CD-ROM, and printed standard  
documentation package

**Opt 0L2** Extra copy of standard  
printed documentation package

**Opt 0B0** Full documentation on  
CD-ROM only

**Opt 0B3** Service Manual

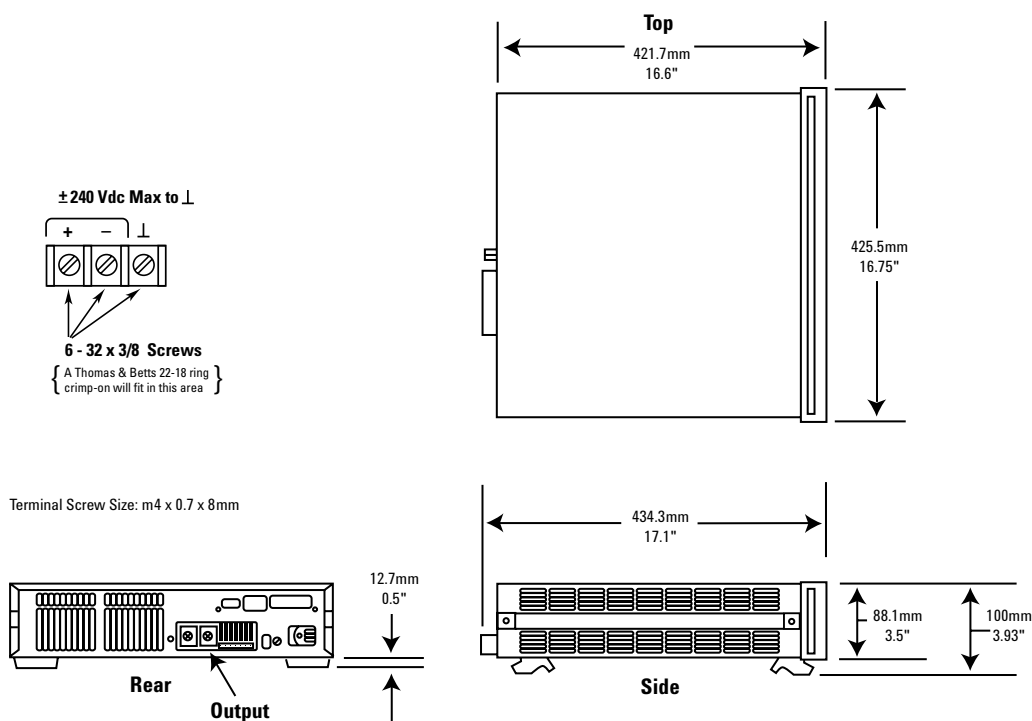
\* Support rails required

### Accessories

p/n 1494-0060 Accessory Slide Kit

**E3663AC** Support rails for Agilent  
rack cabinets

Agilent Models: 6541A, 6542A, 6543A, 6544A, 6545A



More detailed specifications at [www.agilent.com/find/6540](http://www.agilent.com/find/6540)



6651A-6655A

## Single-Output 500 W GPIB

Fast, low-noise outputs

Analog control of output voltage and current

Fan-speed control to minimize acoustic noise

Built-in measurements and advanced programmable features

Protection features to ensure DUT safety

This series of 500 W linear-regulated DC power supplies is designed to maximize the throughput of DUTs through the manufacturing test process with fast up and down programming time.

Valuable assemblies can be destroyed by a minor component failure that causes a surge of current to flow into the DUT. Fast protection features, including fast crowbar, mode crossover protection, and the ability to connect the protection circuitry of multiple power supplies can increase production yield.

Programming of the DC output and the protection features can be done either from the front panel or using industry standard SCPI commands, via the GPIB. Using the serial link, up to 16 power supplies can be connected through one GPIB address. Test system integration can be further simplified by using the *VXIPlug&Play* drivers. The output voltage and current can also be controlled with analog signals. This is helpful for certain types of noisy environments, and also immediate reactions to process changes.

Lab bench use is enhanced by the fan speed control, which helps to minimize the acoustic noise.

### Specifications

(at 0° to 55° C unless otherwise specified)

	6651A	6652A	6653A	6654A	6655A	6651A-J01 Special Order Option
<b>Number of outputs</b>	1	1	1	1	1	1
<b>GPIB</b>	Yes	Yes	Yes	Yes	Yes	Yes
<b>Output ratings</b>						
Output voltage	0 to 8 V	0 to 20 V	0 to 35 V	0 to 60 V	0 to 120 V	10 V
Output current (40° C)	0 to 50 A	0 to 25 A	0 to 15 A	0 to 9 A	0 to 4 A	50 A
Maximum current (50° C/55° C)	45 A/42.5 A	22.5 A/21.3 A	13.5 A/12.8 A	8.1 A/7.7 A	3.6 A/3.4 A	45 A/42.5 A
<b>Programming accuracy at 25° C ±5° C</b>						
Voltage 0.06% +	5 mV	10 mV	15 mV	26 mV	51 mV	6 mV
Current 0.15% +	60 mA	25 mA	13 mA	8 mA	4 mA	60 mA
<b>Ripple and noise</b>						
from 20 Hz to 20 MHz						
Voltage rms	300 µV	300 µV	400 µV	500 µV	700 µV	300 µV
peak-peak	3 mV	3 mV	4 mV	5 mV	7 mV	3 mV
Current rms	25 mA	10 mA	5 mA	3 mA	2 mA	25 mA
<b>Readback accuracy at 25° C ±5° C</b> (percent of reading plus fixed) System models only						
Voltage 0.07% +	6 mV	15 mV	25 mV	40 mV	80 mV	7.5 mV
+Current 0.15% +	67 mA	26 mA	15 mA	7 mA	3 mA	67 mA
–Current 0.35% +	100 mA	44 mA	24 mA	15 mA	7 mA	100 mA
<b>Load regulation</b>						
Voltage	1 mV	2 mV	3 mV	4 mV	5 mV	1 mV
Current	2 mA	1 mA	0.5 mA	0.5 mA	0.5 mA	2 mA
<b>Line regulation</b>						
Voltage	0.5 mV	0.5 mV	1 mV	1 mV	2 mV	0.5 mV
Current	2 mA	1 mA	0.75 mA	0.5 mA	0.5 mA	2 mA
<b>Transient response time</b>	Less than 100 µs for the output voltage to recover to its previous level (within 0.1% of the voltage rating of the supply or 20 mV, whichever is greater) following any step change in load current of up to 50% of rated current					
<b>Supplemental Characteristics</b>	(Non-warranted characteristics determined by design and useful in applying the product)					
<b>Average resolution</b>						
Voltage	2 mV	5 mV	10 mV	15 mV	30 mV	2.5 mV
Current	15 mA	7 mA	4 mA	2.5 mA	1.25 mA	15 mA
OVP	12 mV	30 mV	54 mV	93 mV	190 mV	16 mV
<b>OVP accuracy</b>	160 mV	400 mV	700 mV	1.2 V	2.4 V	200 mV

More detailed specifications at [www.agilent.com/find/6650](http://www.agilent.com/find/6650)



## Single-Output: 500 W GPIB (Continued)

## Application Notes:

**10 Practical Tips You Need to Know About Your Power Products**  
5965-8239E

**10 Hints for Using Your Power Supply to Decrease Test Time**  
5968-6359E

**Understanding Linear Power Supply Operation**  
(AN1554)  
5989-2291EN

**Modern Connectivity - Using USB and LAN I/O Converters**  
(AN 1475-1)  
5989-0123EN

**Agilent DC Power Supplies for Base Station Testing**  
5988-2386EN

## Specifications

(at 0° to 55°C unless otherwise specified)

6651A-J03

Special Order Option

6651A-J09

Special Order Option

6652A-J03

Special Order Option

6653A-J04

Special Order Option

6653A-J17

Special Order Option

## Number of outputs

1

1

1

1

1

## GPIB

Yes

Yes

Yes

Yes

Yes

## Output ratings

## Output voltage

6 V

17V/20 V

27 V

40 V

30 V

## Output current (40°C)

60 A

30 A/15 A

18.5 A

12.5 A

17.5 A

## Maximum current (50°C/55°C)

54 A/5 1A

27 A/25.5 A  
13.5 A/12.75 A

16.65 A/15.72 A

11.25 A/10.6 A

15.75 A/14.87 A

## Programming accuracy at 25°C ±5°C

## Voltage

0.06% +

5 mV

10 mV

13.5 mV

17.5 mV

15 mV

## Current

0.15% +

75 mA

36 mA

25 mA

13 mA

16 mA

## Ripple and noise

## from 20 Hz to 20 MHz

## Voltage rms

300 µV

300 µV

450 µV

1.6 mV

400 µV

## peak-peak

3 mV

4 mV

4.5 mV

5 mV

4 mV

## Current rms

30 mA

13 mA

10 mA

5 mA

6 mA

Readback accuracy at 25°C ±5°C  
(percent of reading plus fixed)  
System models only

## Voltage

0.07% +

6 mV

15 mV

20.5 mV

30 mV

25 mV

## +Current

0.15% +

80 mA

40 mA

26 mA

15 mA

18 mA

## –Current

0.35% +

150 mA

55 mA

44 mA

24 mA

28 mA

## Load regulation

## Voltage

1 mV

2 mV

2 mV

3.5 mV

3 mV

## Current

6.5 mA

2 mA

1 mA

1 mA

0.5 mA

## Line regulation

## Voltage

0.5 mV

0.5 mV

0.5 mV

1 mV

1 mV

## Current

2 mA

2 mA

2 mA

0.75 mA

0.75 mA

## Transient response time

Less than 100 µs for the output voltage to recover to its previous level (within 0.1% of the voltage rating of the supply or 20 mV, whichever is greater) following any step change in load current of up to 50% of rated current

## Supplemental Characteristics

(Non-warranted characteristics determined by design and useful in applying the product)

## Average resolution

## Voltage

2 mV

5 mV

6.75 mV

12mV

10 mV

## Current

18 mA

9 mA

7 mA

4 mA

5 mA

## OVP

12 mV

30 mV

30 mV

65 mV

54 mV

## OVP accuracy

160 mV

500 mV

400 mV

750 mV

700 mV

## Single-Output: 500 W GPIB (Continued)

Supplemental Characteristics  
for all model numbers

**DC Floating Voltage:** Output terminals can be floated up to  $\pm 240$  Vdc from chassis ground

**Remote Sensing:** Up to half the rated output voltage can be dropped in each load lead. The drop in the load leads subtracts from the voltage available for the load.

**Command Processing Time:** Average time required for the output voltage to begin to change following receipt of digital data is 20 ms for the power supplies connected directly to the GPIB

**Output Programming Response Time:** The rise and fall time (10/90% and 90/10%) of the output voltage is less than 15 ms. The output voltage change settles within 1 LSB (0.025% x rated voltage) of final value in less than 60 ms.

**Down Programming:** An active down programmer sinks approximately 20% of the rated output current

**Modulation:** (Analog programming of output voltage and current)

Input signal: 0 to  $-5$  V

Input impedance: 10 k Ohm nominal

**AC Input:** (AC input frequency 47 to 63 Hz)

**Voltage** 100 Vac 120 Vac 220 Vac 240 Vac

**Current** 12 A 10 A 5.7 A 5.3 A

**Input Power:** 1,380 VA, 1,100 W at full load; 120 W at no load

**GPIB Interface Capabilities:** SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, E1, and C0. IEEE-488.2 and SCPI-compatible command set.

**Software Driver:**

- IVI-COM
- VXIPlug&Play

**Regulatory Compliance:** Listed to UL 1244; conforms to IEC 61010-1.

**Size:** 425.5 mm W x 132.6 mm H x 497.8 mm D (16.75 in x 5.22 in x 19.6 in)

**Weight:** Net, 25 kg (54 lb); shipping, 28 kg (61 lb)

**Warranty Period:** One year

## Specifications

(at 0° to 55°C unless otherwise specified)

	6654A-J04 Special Order Option	6654A-J05 Special Order Option	6654A-J12 Special Order Option	6655A-J05 Special Order Option	6655A-J10 Special Order Option
<b>Number of outputs</b>	1	1	1	1	1
<b>GPIB</b>	Yes	Yes	Yes	Yes	Yes
<b>Output ratings</b>					
Output voltage	70 V	50 V	80 V	150 V	156 V
Output current (40°C)	7.5 A	10 A	6 A	3.2 A	3 A
Maximum current (50°C/55°C)	6.75 A/6.37 A	9 A/8.5 A	5.4 A/5.1 A	2.88 A/2.72 A	2.7 A/2.55 A
<b>Programming accuracy</b> at 25°C $\pm 5^\circ\text{C}$					
Voltage 0.06% +	30 mV	26 mV	35 mV	64 mV	71 mV
Current 0.15% +	7 mA	9 mA	7 mA	3.5 mA	4 mA
<b>Ripple and noise</b> from 20 Hz to 20 MHz					
Voltage rms	600 $\mu\text{V}$	500 $\mu\text{V}$	700 $\mu\text{V}$	800 $\mu\text{V}$	900 $\mu\text{V}$
peak-peak	6 mV	5 mV	7 mV	8 mV	8 mV
Current rms	5 mA	4 mA	3 mA	2 mA	3 mA
<b>Readback accuracy</b> at 25°C $\pm 5^\circ\text{C}$ (percent of reading plus fixed) System models only					
Voltage 0.07% +	50 mV	40 mV	58 mV	100 mV	110 mV
+Current 0.15% +	6 mA	8 mA	6 mA	2.5 mA	3 mA
–Current 0.35% +	13 mA	17 mA	16 mA	6.5 mA	7.5 mA
<b>Load regulation</b>					
Voltage	4 mV	4 mV	4 mV	6 mV	7 mV
Current	0.5 mA	0.5 mA	0.5 mA	0.5 mA	1 mA
<b>Line regulation</b>					
Voltage	1 mV	1 mV	4.5 mV	2 mV	2 mV
Current	0.5 mA	0.5 mA	0.5 mA	0.5 mA	1 mA
<b>Transient response time</b>	Less than 100 $\mu\text{s}$ for the output voltage to recover to its previous level (within 0.1% of the voltage rating of the supply or 20 mV, whichever is greater) following any step change in load current of up to 50% of rated current				
<b>Supplemental Characteristics</b>	(Non-warranted characteristics determined by design and useful in applying the product)				
<b>Average resolution</b>					
Voltage	17.5 mV	15 mV	20 mV	37.5 mV	39.5 mV
Current	1.9 mA	2.75 mA	1.7 mA	8 mA	8 mA
OVP	110 mV	93 mV	130 mV	240 mV	250 mV
<b>OVP accuracy</b>	1.4 V	1.2 V	1.6 V	3 V	3.3 V

More detailed specifications at [www.agilent.com/find/6650](http://www.agilent.com/find/6650)

## Single-Output: 500 W GPIB (Continued)

### Ordering Information

**Opt 100** 87 to 106 Vac, 47 to 63 Hz

**Opt 120** 104 to 127 Vac, 47 to 63 Hz

**Opt 220** 191 to 233 Vac, 47 to 63 Hz

**Opt 240** 209 to 250 Vac, 47 to 63 Hz

**\* Opt 908** Rack-mount Kit  
(p/n 5062-3977)

**\* Opt 909** Rack-mount Kit  
w/ Handles (p/n 5063-9221)

**Opt 0L1** Full documentation on  
CD-ROM, and printed standard  
documentation package

**Opt 0L2** Extra copy of standard  
printed documentation package

**Opt 0B0** Full documentation on  
CD-ROM only

**Opt 0B3** Service Manual

\* Support rails required

### Accessories

**p/n 1494-0059** Accessory Slide Kit

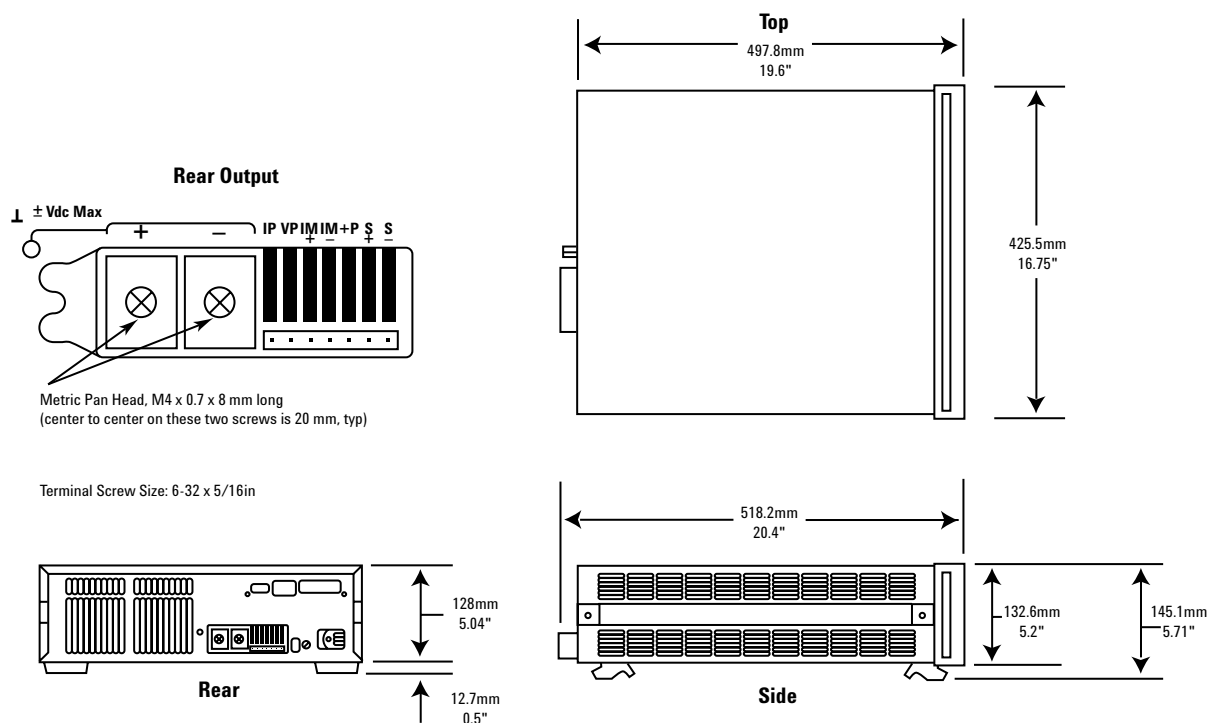
**p/n 1252-3698** 7-pin Analog Plug

**p/n 1252-1488** 4-pin Digital Plug

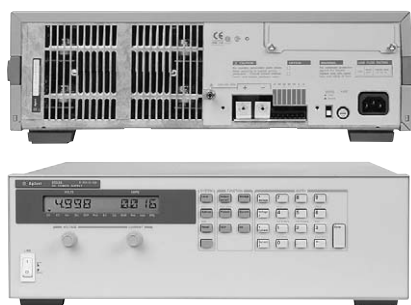
**p/n 5080-2148** Serial Link  
Cable 2 m (6.6 ft)

**E3663AC** Support rails for  
Agilent rack cabinets

**Agilent Models: 6651A, 6652A, 6653A, 6654A, 6655A**



More detailed specifications at [www.agilent.com/find/6650](http://www.agilent.com/find/6650)



6551A-6555A

## Single-Output 500 W

Front panel and analog control of output voltage and current

Fast, low-noise outputs

Fan-speed control to minimize acoustic noise

Protection features to ensure DUT safety

This reliable series of 500 W DC power supplies can be controlled either from the front panel or via an analog programming voltage. When used in a test system, the fast up and down programming helps decrease test time. Quickly reacting protection features, including fast crowbar, CV/CC mode crossover and over-voltage protection help protect your valuable assemblies from damage. The linear topology produces very low ripple and noise, which allows you to make extremely accurate measurements of the devices which you are testing.

Lab bench use is enhanced by the fan speed control, which helps to minimize the acoustic noise.

### Specifications

(at 0° to 55° C unless otherwise specified)

	6551A	6552A	6553A	6554A	6555A
<b>Number of outputs</b>	1	1	1	1	1
<b>GPIB</b>	No	No	No	No	No
<b>Output ratings</b>					
Output voltage	0 to 8 V	0 to 20 V	0 to 35 V	0 to 60 V	0 to 120 V
Output current (40° C)	0 to 50 A	0 to 25 A	0 to 15 A	0 to 9 A	0 to 4 A
Maximum current (50° C/55° C)	45 A/42.5 A	22.5 A/21.3 A	13.5 A/12.8 A	8.1 A/7.7 A	3.6 A/3.4 A
<b>Programming accuracy at 25° C ±5° C</b>					
Voltage 0.06% +	5 mV	10 mV	15 mV	26 mV	51 mV
Current 0.15% +	60 mA	25 mA	13 mA	8 mA	4 mA
<b>Ripple and noise from 20 Hz to 20 MHz</b>					
Voltage rms	300 µV	300 µV	400 µV	500 µV	700 µV
peak-peak	3 mV	3 mV	4 mV	5 mV	7 mV
Current rms	25 mA	10 mA	5 mA	3 mA	2 mA
<b>Load regulation</b>					
Voltage	1 mV	2 mV	3 mV	4 mV	5 mV
Current	2 mA	1 mA	0.5 mA	0.5 mA	0.5 mA
<b>Line regulation</b>					
Voltage	0.5 mV	0.5 mV	1 mV	1mV	2 mV
Current	2 mA	1 mA	0.75 mA	0.5 mA	0.5 mA
<b>Transient response time</b>	Less than 100 µs for the output voltage to recover to its previous level (within 0.1% of the voltage rating of the supply or 20 mV, whichever is greater) following any step change in load current of up to 50% of rated current				

### Supplemental Characteristics

(Non-warranted characteristics determined by design and useful in applying the product)

<b>Average resolution</b>					
Voltage	2 mV	5 mV	10 mV	15 mV	30 mV
Current	15 mA	7 mA	4 mA	2.5 mA	1.25 mA
OVP	12 mV	30 mV	54 mV	93 mV	190 mV
<b>OVP accuracy</b>	160 mV	400 mV	700 mV	1.2 V	2.4 V

## Single-Output: 500 W (Continued)

## Application Notes:

**10 Practical Tips You Need to Know About Your Power Products**  
5965-8239E

**Understanding Linear Power Supply Operation**  
(AN1554)  
5989-2291EN

**Agilent DC Power Supplies for Base Station Testing**  
5988-2386EN

## Specifications

(at 0° to 55° C unless otherwise specified)

## 6551A-J01

Special Order  
Option

## 6551A-J03

Special Order  
Option

## 6553A-J04

Special Order  
Option

## 6553A-J17

Special Order  
Option

Specifications		6551A-J01 Special Order Option	6551A-J03 Special Order Option	6553A-J04 Special Order Option	6553A-J17 Special Order Option
<b>Number of outputs</b>		1	1	1	1
<b>GPIO</b>		No	No	No	No
<b>Output ratings</b>					
Output voltage		10 V	6 V	40 V	30 V
Output current (40° C)		50 A	60 A	12.5 A	17.5 A
Maximum current (50° C/55° C)		45 A/42.5 A	54 A/51 A	11.25 A/10.6 A	15.75 A/14.87 A
<b>Programming accuracy</b> at 25°C ±5°C					
Voltage	0.06% +	6 mV	5 mV	17.5 mV	15 mV
Current	0.15% +	60 mA	75 mA	13 mA	16 mA
<b>Ripple and noise</b> from 20 Hz to 20 MHz					
Voltage rms		300 µV	300 µV	1.6 mV	400 µV
peak-peak		3 mV	3 mV	5 mV	4 mV
Current rms		25 mA	30 mA	5 mA	6 mA
<b>Load regulation</b>					
Voltage		1 mV	1 mV	3.5 mV	3 mV
Current		2 mA	6.5 mA	1 mA	0.5 mA
<b>Line regulation</b>					
Voltage		0.5 mV	0.5 mV	1 mV	1 mV
Current		2 mA	2 mA	0.75 mA	0.75 mA
<b>Transient response time</b>		Less than 100 µs for the output voltage to recover to its previous level (within 0.1% of the voltage rating of the supply or 20 mV, whichever is greater) following any step change in load current of up to 50% of rated current			
<b>Supplemental Characteristics</b>		(Non-warranted characteristics determined by design and useful in applying the product)			
<b>Average resolution</b>					
Voltage		2.5 mV	2 mV	12 mV	10 mV
Current		15 mA	18 mA	4 mA	5 mA
OVP		16 mV	12 mV	65 mV	54 mV
<b>OVP accuracy</b>		200 mV	160 mV	750 mV	700 mV

More detailed specifications at [www.agilent.com/find/6550](http://www.agilent.com/find/6550)

## Single-Output: 500 W (Continued)

**Supplemental Characteristics  
for all model numbers**

**DC Floating Voltage:** Output terminals can be floated up to  $\pm 240$  Vdc from chassis ground

**Remote Sensing:** Up to half the rated output voltage can be dropped in each load lead. The drop in the load leads subtracts from the voltage available for the load.

**Output Programming Response Time:** The rise and fall time (10/90% and 90/10%) of the output voltage is less than 15 ms. The output voltage change settles within 1 LSB (0.025% x rated voltage) of final value in less than 60 ms.

**Down Programming:** An active down programmer sinks approximately 20% of the rated output current

**Modulation:** (Analog programming of output voltage and current)  
Input signal: 0 to -5 V  
Input impedance: 10 k Ohm nominal

**AC Input:** (AC input frequency 47 to 63 Hz)

**Voltage** 100 Vac 120 Vac 220 Vac 240 Vac

**Current** 12 A 10 A 5.7 A 5.3 A

**Input Power:** 1,380 VA, 1,100 W at full load; 120 W at no load

**Regulatory Compliance:** Listed to UL 1244; certified to CSA556B; conforms to IEC 61010-1.

**Size:** 425.5 mm W x 132.6 mm H x 497.8 mm D (16.75 in x 5.22 in x 19.6 in)

**Weight:** Net, 25 kg (54 lb); shipping, 28 kg (61 lb)

**Warranty Period:** One year

**Specifications**

(at 0° to 55° C unless otherwise specified)

**6554A-J04**

Special Order Option

**6554A-J05**

Special Order Option

**6554A-J12**

Special Order Option

**6555A-J10**

Special Order Option

		6554A-J04 Special Order Option	6554A-J05 Special Order Option	6554A-J12 Special Order Option	6555A-J10 Special Order Option
<b>Number of outputs</b>		1	1	1	1
<b>GPIO</b>		No	No	No	No
<b>Output ratings</b>					
Output voltage		70 V	50 V	80 V	156 V
Output current (40° C)		7.5 A	10 A	6 A	3 A
Maximum current (50° C/55° C)		6.75 A/6.37 A	9 A/8.5 A	5.4 A/5.1 A	2.7 A/2.55 A
<b>Programming accuracy at 25°C <math>\pm 5^\circ\text{C}</math></b>					
Voltage	0.06% +	38 mV	26 mV	35 mV	71 mV
Current	0.15% +	7 mA	9 mA	7 mA	4 mA
<b>Ripple and noise from 20 Hz to 20 MHz</b>					
Voltage rms		600 $\mu\text{V}$	500 $\mu\text{V}$	700 $\mu\text{V}$	900 $\mu\text{V}$
peak-peak		6 mV	5 mV	5 mV	8 mV
Current rms		5 mA	4 mA	3 mA	3 mA
<b>Load regulation</b>					
Voltage		4 mV	4 mV	4 mV	7 mV
Current		0.5 mA	0.5 mA	0.5 mA	1 mA
<b>Line regulation</b>					
Voltage		1 mV	1 mV	4.5 mV	2 mV
Current		0.5 mA	0.5 mA	0.5 mA	1 mA
<b>Transient response time</b>		Less than 100 $\mu\text{s}$ for the output voltage to recover to its previous level (within 0.1% of the voltage rating of the supply or 20 mV, whichever is greater) following any step change in load current of up to 50% of rated current			
<b>Supplemental Characteristics</b>		(Non-warranted characteristics determined by design and useful in applying the product)			
<b>Average resolution</b>					
Voltage		17.5 mV	15 mV	20 mV	39.5 mV
Current		1.9 mA	2.75 mA	1.7 mA	8 mA
<b>OVP</b>		110 mV	93 mV	130 mV	250 mV
<b>OVP accuracy</b>		1.4 V	1.2 V	1.6 V	3.3 V

## Single-Output: 500 W (Continued)

### Ordering Information

**Opt 100** 87 to 106 Vac, 47 to 63 Hz

**Opt 120** 104 to 127 Vac, 47 to 63 Hz

**Opt 220** 191 to 233 Vac, 47 to 63 Hz

**Opt 240** 209 to 250 Vac, 47 to 63 Hz

\* **Opt 908** Rack-mount Kit  
(p/n 5062-3977)

\* **Opt 909** Rack-mount Kit  
w/ Handles (p/n 5063-9221)

**Opt 0L1** Full documentation on  
CD-ROM, and printed standard  
documentation package

**Opt 0L2** Extra copy of standard  
printed documentation package

**Opt 0B0** Full documentation on  
CD-ROM only

**Opt 0B3** Service Manual

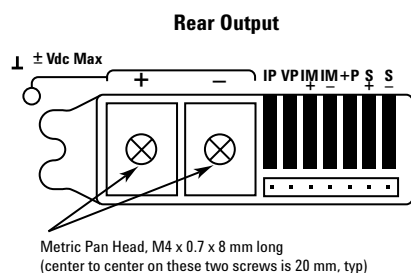
\* Support rails required

### Accessories

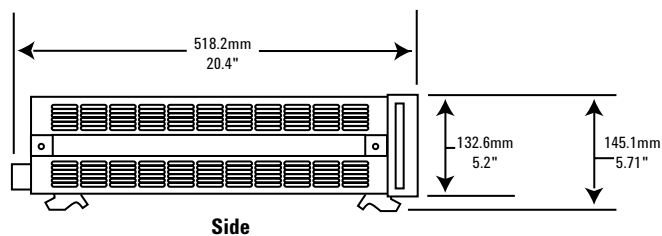
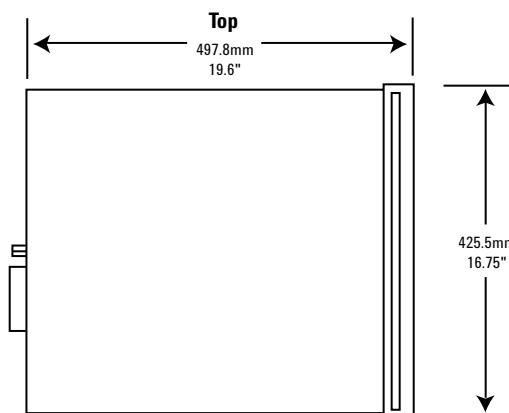
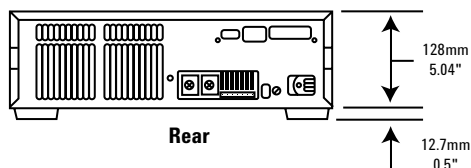
p/n 1494-0059 Accessory Slide Kit

**E3663AC** Support rails for Agilent  
rack cabinets

Agilent Models: 6551A, 6552A, 6553A, 6554A, 6555A



Terminal Screw Size: 6-32 x 5/16in



More detailed specifications at [www.agilent.com/find/6550](http://www.agilent.com/find/6550)



6671A - 6675A

## Single-Output 2000 W GPIB

Fast, low-noise outputs

Analog control of output voltage and current

Fan-speed control to minimize acoustic noise

Built-in measurements and advanced programmable features

Protection features to ensure DUT safety

This series of 2000 watt DC power supplies has the exceptional, proven reliability that test system engineers look for. It also has the unusual combination of high efficiency and low noise operation.

Programming of the DC output and the extensive protection features can be done either from the front panel or using industry standard SCPI commands, via the GPIB. Using the serial link, up to 16 power supplies can be connected through one GPIB address. Test system integration can be further simplified by using the *VXIPlug&Play* drivers. The output voltage and current can also be controlled with analog signals. This is helpful for certain types of noisy environments, and also immediate reactions to process changes.

Lab-bench use is enhanced by the fan-speed control, which minimizes acoustic noise. The extremely low ripple and noise helps the built-in measurement system make extremely accurate current and voltage measurements.

### Specifications

(at 0° to 55° C unless  
otherwise specified)

	6671A	6672A	6673A	6674A	6675A
<b>Number of outputs</b>	1	1	1	1	1
<b>GPIB</b>	Yes	Yes	Yes	Yes	Yes
<b>Output ratings</b>					
Output voltage	0 to 8 V	0 to 20 V	0 to 35 V	0 to 60 V	0 to 120 V
Output current	0 to 220 A	0 to 100 A	0 to 60 A	0 to 35 A	0 to 18 A
<b>Programming accuracy</b> at 25° C ±5° C					
Voltage	0.04% + 8 mV	20 mV	35 mV	60 mV	120 mV
Current	0.1% + 125 mA	60 mA	40 mA	25 mA	12 mA
<b>Ripple and noise</b>					
from 20 Hz to 20 MHz					
Voltage rms	650 µV	750 µV	800 µV	1.25 mV	1.9 mV
Voltage peak to peak	7 mV	9 mV	9 mV	11 mV	16 mV
Current rms	200 mA	100 mA	40 mA	25 mA	12 mA
<b>Readback accuracy</b> at 25° C ±5° C (percent of reading plus fixed)					
Voltage	0.05% + 12 mV	30 mV	50 mV	90 mV	180 mV
±Current	0.1% + 150 mA	100 mA	60 mA	35 mA	18 mA
<b>Load regulation</b>					
Voltage	0.002%+ 300 µV	650 µV	1.2 mV	2 mV	4 mV
<b>Line regulation</b>					
Current	0.005%+ 10 mA	7 mA	4 mA	2 mA	1 mA

**Transient response time** Less than 900 µs for the output voltage to recover 100 mV following a change in load from 100% to 50% or 50% to 100% of the output current rating of the supply

**Supplemental Characteristics** (Non-warranted characteristics determined by design and useful in applying the product)

<b>Average resolution</b>					
Voltage	2 mV	5 mV	10 mV	15 mV	30 mV
Current	55 mA	25 mA	15 mA	8.75 mA	4.5 mA
OVP	15 mV	35 mV	65 mV	100 mV	215 mV
<b>Output Voltage programming response time*</b>					
(excluding command processing time)	30 ms	60 ms	130 ms	130 ms	195 ms

\* Full load programming rise/fall time (10% to 90% or 90% to 10%) with full resistive load equal to rated output voltage/rated output current.

More detailed specifications at [www.agilent.com/find/6670](http://www.agilent.com/find/6670)



## Single-Output: 2000 W GPIB (Continued)

## Application Notes:

6671A/72A/81A/82A/90A  
System DC Power Supplies Product Overview  
5988-3050EN

Agilent DC Power Supplies  
for Base Station Testing  
5988-2386EN

10 Practical Tips You Need to  
Know About Your Power Products  
5965-8239E

## Specifications

(at 0° to 55° C unless  
otherwise specified)

6671A-  
J03  
Special Order  
Option

6671A-  
J04  
Special Order  
Option

6671A-  
J08  
Special Order  
Option

6671A-  
J17  
Special Order  
Option

6672A-  
J04  
Special Order  
Option

6673A-  
J03  
Special Order  
Option

Specifications		6671A- J03 Special Order Option	6671A- J04 Special Order Option	6671A- J08 Special Order Option	6671A- J17 Special Order Option	6672A- J04 Special Order Option	6673A- J03 Special Order Option
<b>Number of outputs</b>		1	1	1	1	1	1
<b>GPIB</b>		Yes	Yes	Yes	Yes	Yes	Yes
<b>Output ratings</b>							
Output voltage		14 V	10 V	3 V	15 V	24 V	37.5 V
Output current		150 A	200 A	300 A	120 A	85 A	45 A
<b>Programming accuracy</b> at 25° C ±5° C							
Voltage	0.04%+	14 mV	10 mV	4 mV	15 mV	25 mV	37.5 mV
Current	0.1%+	90 mA	125 mA	250 mA	90 mA	60 mA	40 mA
<b>Ripple and noise</b>							
from 20 Hz to 20 MHz							
Voltage rms		1.5 mV	750 µV	1 mV	1.5 mV	1 mV	800 µV
Voltage peak to peak		15 mV	9 mV	25 mV	15 mV	11 mV	9 mV
Current rms		150 mA	200 mA	275 mA	150 mA	100 mA	40 mA
<b>Readback accuracy</b> at 25° C ±5° C (percent of reading plus fixed) System models only							
Voltage	0.05% +	25 mV	15 mV	6 mV	27 mV	40 mV	53.5 mV
±Current	0.1% +	110 mA	150 mA	250 mA	110 mA	100 mA	60 mA
<b>Load regulation</b>							
Voltage	0.002%+	600 µV	300 µV	300 µV	650 µV	650 µV	1.2 mV
<b>Line regulation</b>							
Current	0.005%+	7 mA	10 mA	15 mA	7 mA	7 mA	4 mA
<b>Transient response time</b>		Less than 900 µs for the output voltage to recover 100 mV following a change in load from 100% to 50% or 50% to 100% of the output current rating of the supply					

## Supplemental Characteristics

(Non-warranted characteristics determined by design and useful in applying the product)

<b>Average resolution</b>							
Voltage		4 mV	2.5 mV	1 mV	4 mV	6 mV	10 mV
Current		40 mA	55 mA	75 mA	35 mA	22 mA	15 mA
OVP		28 mV	20 mV	8 mV	30 mV	42 mV	65 mV
<b>Output Voltage programming response time*</b>							
(excluding command programming processing time)		30 ms	35 ms	30 ms	35 ms	70 ms	130 ms

\* Full load programming rise/fall time (10% to 90% or 90% to 10%) with full resistive load equal to rated output voltage/rated output current.

## Single-Output: 2000 W GPIB (Continued)

**Supplemental Characteristics  
for all model numbers**

**DC Floating Voltage:** Output terminals can be floated up to  $\pm 240$  Vdc from chassis ground

**Output Common-Mode Noise Current:** (to signal ground binding post)  
500  $\mu$ A rms, 4 mA peak-to-peak

**Remote Sensing:** Up to half the rated output voltage can be dropped in each load lead. The drop in the load leads subtracts from the voltage available for the load.

**Command Processing Time:** Average time required for the output voltage to begin to change following receipt of digital data is 20 ms for the power supplies connected directly to the GPIB.

**Modulation:** (Analog programming of output voltage and current)

**Input Signal:** 0 to  $-4$  V for voltage, 0 to 7 V for current

**Input Impedance:** 60 k Ohm or greater

**Input Power:** 3,800 VA, 2,600 W at full load; 170 W at no load

**GPIB Interface Capabilities:** SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, E1, and C0. IEEE-488.2 and SCPI-compatible command set

**Software Driver:**

- IVI-COM
- VXIPlug&Play

**Regulatory Compliance:** Listed to UL1244; certified to CSA556B; conforms to IEC 61010-1.

**Size:** 425.5 mm W x 132.6 mm H x 640 mm D (16.75 in x 5.22 in x 25.2 in)

**Weight:** Net, 28.2 kg (62 lbs); shipping, 31.8 kg (70 lbs)

**Warranty Period:** One year

**Specifications**

(at 0° to 55°C unless otherwise specified)

	<b>6673A-J08</b> Special Order Option	<b>6674A-J03</b> Special Order Option	<b>6674A-J07</b> Special Order Option	<b>6675A-J04</b> Special Order Option	<b>6675A-J06</b> Special Order Option
<b>Number of outputs</b>	1	1	1	1	1
<b>GPIB</b>	Yes	Yes	Yes	Yes	Yes
<b>Output ratings</b>					
Output voltage	40 V	56 V	50 V	160 V	135 V
Output current	50 A	38 A	42 A	13 A	16 A
<b>Programming accuracy</b> at 25°C $\pm 5^\circ$ C					
Voltage 0.04%+	40 mV	60 mV	60 mV	160 mV	125 mV
Current 0.1%+	35 mA	28 mA	30 mA	10 mA	12 mA
<b>Ripple and noise</b>					
from 20 Hz to 20 MHz					
Voltage rms	1 mV	1.25 mV	1.25 mV	2.8 mV	2 mV
Voltage peak to peak	10.5 mV	11 mV	11 mV	20 mV	18 mV
Current rms	40 mA	28 mA	25 mA	18 mA	12 mA
<b>Readback accuracy</b> at 25°C $\pm 5^\circ$ C (percent of reading plus fixed) System models only					
Voltage 0.05%+	60 mV	90 mV	90 mV	240 mV	185 mV
$\pm$ Current 0.1%+	60 mA	38 mA	42 mA	14 mA	18 mA
<b>Load regulation</b>					
Voltage 0.002%+	1.4 mV	2 mV	2 mV	6 mV	4 mV
<b>Line regulation</b>					
Current 0.005%+	4 mA	2 mA	2 mA	1 mA	4 mV
<b>Transient response time</b>	Less than 900 $\mu$ s for the output voltage to recover 100 mV following a change in load from 100% to 50% or 50% to 100% of the output current rating of the supply				

**Supplemental Characteristics**

(Non-warranted characteristics determined by design and useful in applying the product)

<b>Average resolution</b>					
Voltage	10.5 mV	14 mV	12 mV	40 mV	34 mV
Current	12.5 mA	9.5 mA	11 mA	3.25 mA	4 mA
OVP	75 mV	100 mV	85 mV	300 mV	242 mV
<b>Output Voltage programming response time*</b>					
(excluding command programming processing time)	130 ms	130 ms	130 ms	280 ms	250 ms

\* Full load programming rise/fall time (10% to 90% or 90% to 10%) with full resistive load equal to rated output voltage/rated output current.

# Single-Output: 2000 W GPIB (Continued)

## Ordering Information

**Opt 200** 174 to 220 Vac, 47 to 63 Hz (Japan only)

**Opt 230** 191 to 250 Vac, 47 to 63 Hz

\* **Opt 908** Rack-mount Kit (p/n 5062-3977)

\* **Opt 909** Rack-mount Kit w/handles (p/n 5063-9221)

**Opt 0L1** Full documentation on CD-ROM, and printed standard documentation package

**Opt 0L2** Extra copy of standard printed documentation package

**Opt 0B0** Full documentation on CD-ROM only

**Opt 0B3** Service Manual

**A line cord option must be specified, see the AC line voltage and cord section.**

\* Support rails required

## Accessories

**p/n 1494-0059** Accessory Slide Kit

**p/n 1252-3698** 7-pin Analog Plug

**p/n 1252-1488** 4-pin Digital Plug

**p/n 5080-2148** Serial Link Cable 2 m (6.6 ft)

**E3663AC** Support rails for Agilent rack cabinets

## Specifications

(at 0° to 55°C unless otherwise specified)

**6675A-J07**  
Special Order Option

**6675A-J08**  
Special Order Option

**6675A-J09**  
Special Order Option

**6675A-J11**  
Special Order Option

### Number of outputs

1

1

1

1

### GPIB

Yes

Yes

Yes

Yes

### Output ratings

Output voltage

200 V

100 V

110 V

150 V

Output current

11 A

22 A

20 A

15 A

### Programming accuracy at 25°C ±5°C

Voltage

0.04%+

200 mV

120 mV

120 mV

150 mV

Current

0.1%+

8 mA

15 mA

13.5 mA

11 mA

### Ripple and noise

from 20 Hz to 20 MHz

Voltage rms

3.5 mV

1.9 mV

1.9 mV

2.5 mV

Voltage peak to peak

25 mV

16 mV

16 mV

18 mV

Current rms

15 mA

15 mA

13.5 mA

12 mA

### Readback accuracy at 25°C ±5°C

(percent of reading plus fixed)

System models only

Voltage

0.05%+

300 mV

180 mV

180 mV

225 mV

±Current

0.1%+

12 mA

22 mA

20 mA

15 mA

### Load regulation

Voltage

0.002% +

7 mV

4 mV

4 mV

6 mV

### Line regulation

Current

0.005% +

1 mA

4 mV

4 mV

1 mA

### Transient response time

Less than 900 µs for the output voltage to recover 100 mV following a change in load from 100% to 50% or 50% to 100% of the output current rating of the supply

## Supplemental Characteristics

(Non-warranted characteristics determined by design and useful in applying the product)

### Average resolution

Voltage

50 mV

30 mV

30 mV

37.5 mV

Current

2.75 mA

4.5 mA

4.5 mA

3.75 mA

OVP

360 mV

215 mV

215 mV

270 mV

### Output Voltage programming response time\*

(excluding command

programming processing time)

350 ms

195 ms

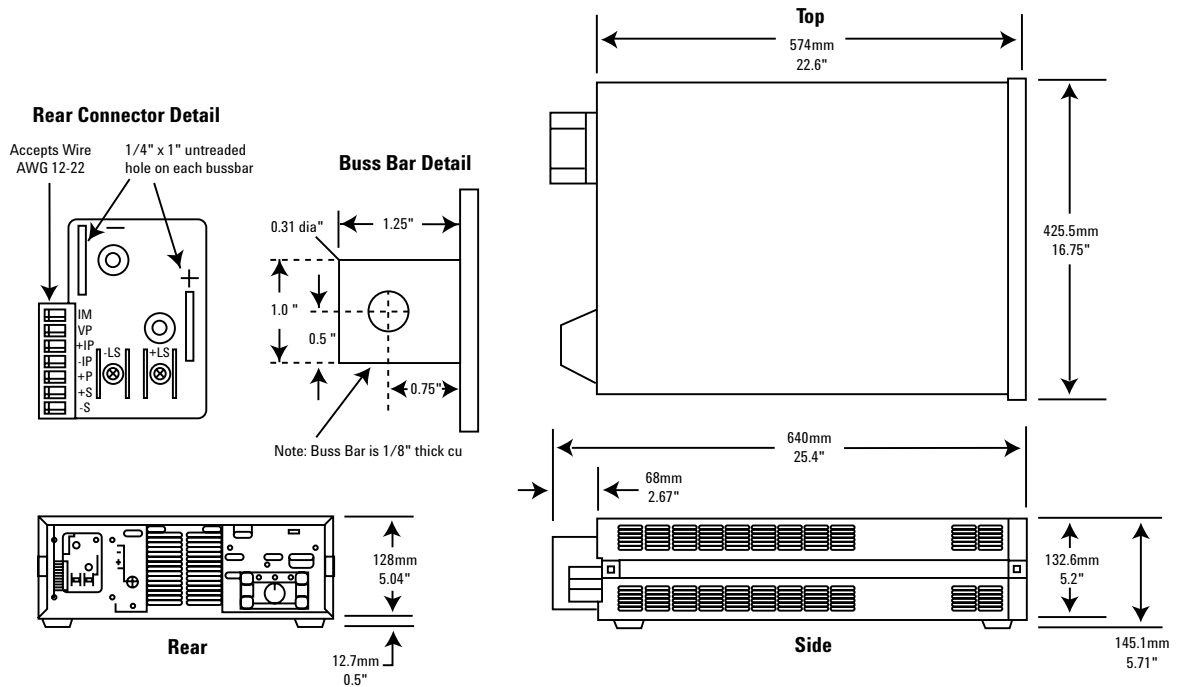
195 ms

250 ms

\* Full load programming rise/fall time (10% to 90% or 90% to 10%) with full resistive load equal to rated output voltage/rated output current.

## Single-Output: 2000 W GPIB (Continued)

Agilent Models: 6671A, 6672A, 6673A, 6674A, 6675A



More detailed specifications at [www.agilent.com/find/6670](http://www.agilent.com/find/6670)



E4356A

## Single-Output 2000 W GPIB

- Dual range output
- Fast, low-noise outputs
- Analog control of output voltage and current
- Fan-speed control to minimize acoustic noise
- Built-in measurements and advanced programmable features
- Protection features to ensure DUT safety

### Specifications

(at 0° to 55°C unless  
otherwise specified)

#### E4356A

This 2000 W DC power supply provides over 2000 watts at either 70 or 80 volts. This makes it particularly suitable for a variety of test scenarios for 48 volt systems. Telephone network equipment is one example of such a 48 volt bus application. It also has the unusual combination of high efficiency and low noise operation.

Programming of the DC output and the extensive protection features can be done either from the front panel or using industry standard SCPI commands, via the GPIB. Using the serial link, up to 16 power supplies can be connected through one GPIB address. Test system integration can be further simplified by using the *VXIPlug&Play* drivers. The output voltage and current can also be controlled with analog signals. This is helpful for certain types of noisy environments, and also immediate reactions to process changes.

Lab-bench use is enhanced by the fan-speed control, which minimizes acoustic noise. The extremely low ripple and noise helps the built-in measurement system make extremely accurate current and voltage measurements.

<b>Number of outputs</b>	1
<b>GPIB</b>	Yes
<b>Output ratings</b>	
Voltage	0 to 70 V/0 to 80 V
Current	0 to 30 A/0 to 26 A
<b>Programming accuracy</b> at 25°C ±5°C (% of setting plus fixed)	
Voltage	0.04% + 80 mV
+Current	0.1% + 25 mA
<b>Ripple and noise</b>	
20 Hz to 20 MHz	
Voltage rms	2 mV
peak-peak	16 mV
Current rms	25 mA
<b>DC measurement accuracy</b> (via GPIB or front panel meters with respect to actual output at 25°C ±5°C)	
Voltage	0.05% + 120 mV
Current	0.1% + 35 mA
<b>Transient response time</b> Time for the output voltage to recover to within 20 mV or 0.1% of the voltage rating of the unit following a change in load current of up to 50% of the output current rating.	<900 µs

### Application Notes:

**Agilent DC Power Supplies  
for Base Station Testing**  
5988-2386EN

**10 Practical Tips You Need to  
Know About Your Power Products**  
5965-8239E

**10 Hints for Using Your Power Supply  
to Decrease Test Time**  
5968-6359E

### Supplemental Characteristics for all model numbers

**DC Floating Voltage:** Output terminals can be floated up to ±240 Vdc maximum from chassis ground.

**Remote Sensing:** Up to half the rated output voltage can be dropped in each load lead. The drop in the load leads subtracts from the voltage available for the load.

More detailed specifications at [www.agilent.com/find/E4356](http://www.agilent.com/find/E4356)

## Single-Output: 2000 W GPIB (Continued)

**Command Processing Time:** Average time required for the output voltage to begin to change following receipt of digital data is 20 ms for the power supplies connected directly to the GPIB. (Display disabled.)

**Output Voltage Rise Time/Fall Time:** 100 ms/200 ms for output to change from 90% to 10% or from 10% to 90% of its total excursion with full resistive load (excludes command processing time).

**Modulation:** (Analog programming of output voltage and current)

**Input Signal:** 0 to -4 V for voltage and current

**Input Impedance:** 60 k Ohm nominal

**Input Power:** 3800 VA, 2600 W at full load; 100 W at no load

**GPIB Interface Capabilities:** SH1, AH1, TE6, LE4, SR1, RL1, PP0, DC1, DT1, E1 and C0. IEEE-488.2 and SCPI-compatible command set

**Software Driver:**

- IVI-COM
- VXIPlug&Play

**Regulatory Compliance:** Listed to UL1244; certified to CSA556B, conforms to EN61010.

**Warranty Period:** One year

**Size:** 425.5 mm W x 132.6 mm H x 640 mm D

See page 102 for more details

**Weight:** 27.7 kg (61 lbs) net, 31.4 kg (69 lbs) shipping.

### Ordering Information

**Opt 200** 174 to 220 Vac, 47 to 63 Hz (Japan only)

**Opt 230** 191 to 250 Vac, 47 to 63 Hz

\* **Opt 908** Rack-mount Kit (p/n 5062-3977)

\* **Opt 909** Rack-mount Kit w/Handles (p/n 5063-9221)

**Opt 0L1** Full documentation on CD-ROM, and printed standard documentation package

**Opt 0L2** Extra copy of standard printed documentation package

**Opt 0B0** Full documentation on CD-ROM only

**Opt 0B3** Service Manual

**A line cord option must be specified, see the AC line voltage and cord section.**

\* Support rails required

### Accessories

p/n 1494-0059 Accessory Slide Kit

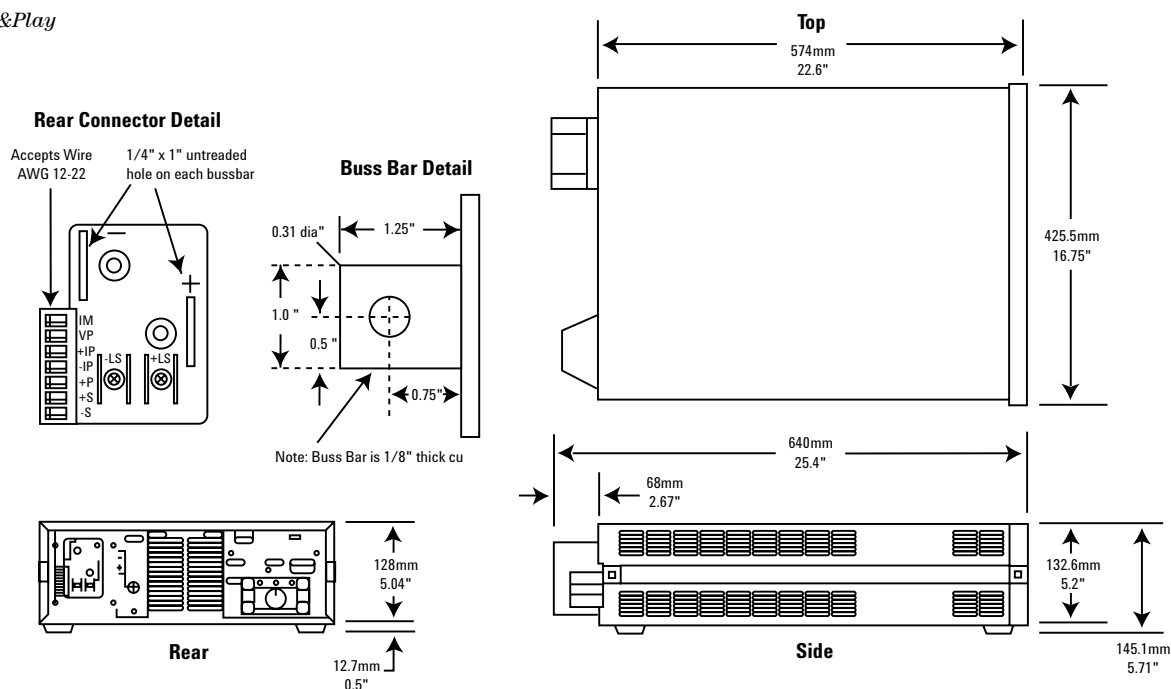
p/n 1252-3698 7-pin Analog Plug

p/n 1252-1488 4-pin Digital Plug

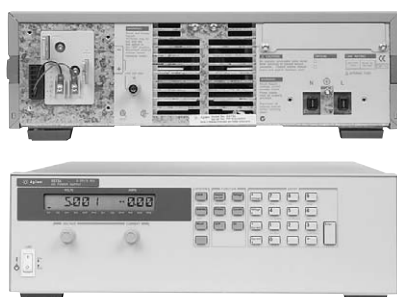
p/n 5080-2148 Serial Link Cable 2 m (6.6 ft)

**E3663AC** Support rails for Agilent rack cabinets

### Agilent Models: E4356A



More detailed specifications at [www.agilent.com/find/E4356](http://www.agilent.com/find/E4356)



6571A-6575A

## Single-Output 2000 W

Front panel and analog control of output voltage and current

Fast, low-noise outputs

Fan-speed control to minimize acoustic noise

Protection features to ensure DUT safety

This series of 2000 watt DC power supplies has the exceptional, proven reliability that test system engineers look for. It also has the unusual combination of high efficiency and low noise operation.

These DC power supplies can be controlled either from the front panel or via an analog programming voltage. When used in a test system, the fast up and down programming helps decrease test time. Quickly reacting protection features, including CV/CC mode crossover and over-voltage protection help protect your valuable assemblies from damage.

Lab-bench use is enhanced by the fan-speed control, which minimizes acoustic noise. The extremely low ripple and noise helps the test engineer make extremely accurate current and voltage measurements.

### Specifications

(at 0° to 55°C unless otherwise specified)

		6571A	6572A	6573A	6574A	6575A	6571A-J03 Special Order Option
<b>Number of outputs</b>		1	1	1	1	1	1
<b>GPIO</b>		No	No	No	No	No	No
<b>Output ratings</b>							
Output voltage		0 to 8 V	0 to 20 V	0 to 35 V	0 to 60 V	0 to 120 V	14 V
Output current		0 to 220 A	0 to 100 A	0 to 60 A	0 to 35 A	0 to 18 A	150 A
<b>Programming accuracy</b> at 25°C ±5°C							
Voltage	0.04% +	8 mV	20 mV	35 mV	60 mV	120 mV	14 mV
Current	0.1% +	125 mA	60 mA	40 mA	25 mA	12 mA	90 mA
<b>Ripple and noise</b> from 20 Hz to 20 MHz							
Voltage rms		650 µV	750 µV	800 µV	1.25 mV	1.9 mV	1.5 mV
peak-peak		7 mV	9 mV	9 mV	11 mV	16 mV	15 mV
Current rms		200 mA	100 mA	40 mA	25 mA	12 mA	150 mA
<b>Load regulation and line regulation</b>							
Voltage	0.002%+	300 µV	650 µV	1.2 mV	2 mV	4 mV	600 µV
Current	0.005%+	10 mA	7 mA	4 mA	2 mA	1 mA	7 mA
<b>Transient response time</b>		Less than 900 µs for the output voltage to recover 100 mV following a change in load from 100% to 50% or 50% to 100% of the output current rating of the supply					
<b>Supplemental Characteristics</b>		(Non-warranted characteristics determined by design and useful in applying the product)					
<b>Average resolution</b>							
Voltage		2 mV	5 mV	9 mV	15 mV	30 mV	4 mV
Current		55 mA	25 mA	15 mA	8.75 mA	4.5 mA	40 mA
OVP		15 mV	35 mV	65 mV	100 mV	215 mV	28 mV
<b>Output voltage programming response time*</b>							
*Full load programming rise/fall time (10% to 90% or 90% to 10%) with full resistive load equal to rated output voltage/rated output current.		30 ms	60 ms	130 ms	130 ms	195 ms	30 ms

More detailed specifications at [www.agilent.com/find/6570](http://www.agilent.com/find/6570)

## Single-Output: 2000 W (Continued)

## Application Notes:

Agilent DC Power Supplies  
for Base Station Testing

5988-2386EN

10 Practical Tips You Need to  
Know About Your Power Products

5965-8239E

Supplemental Characteristics  
for all model numbers

**DC Floating Voltage:** Output terminals can be floated up to  $\pm 240$  Vdc from chassis ground

**Output Common-Mode Noise Current:** (to signal ground binding post)  
500  $\mu$ A rms, 4 mA peak-to-peak

**Remote Sensing:** Up to half the rated output voltage can be dropped in each load lead. The drop in the load leads subtracts from the voltage available for the load.

**Modulation:** (Analog programming of output voltage and current)

**Input Signal:** 0 to  $-4$  V for voltage, 0 to 7 V for current

**Input Impedance:** 30 k Ohm or greater

**Input Power:** 3,800 VA, 2,600 W at full load; 170 W at no load

**Regulatory Compliance:** Listed to UL1244; certified to CSA556B; conforms to IEC 61010-1.

**Size:** 425.5 mm W x 132.6 mm H x 640 mm D (16.75 in x 5.22 in x 25.2 in)

**Weight:** Net, 28.2 kg (62 lb); shipping, 31.8 kg (70 lb)

**Warranty Period:** One year

## Specifications

(at 0° to 55°C unless otherwise specified)

6571A-J04  
Special Order Option6571A-J17  
Special Order Option6573A-J03  
Special Order Option6573A-J08  
Special Order Option6574A-J03  
Special Order Option6574A-J07  
Special Order Option

Specifications		6571A-J04 Special Order Option	6571A-J17 Special Order Option	6573A-J03 Special Order Option	6573A-J08 Special Order Option	6574A-J03 Special Order Option	6574A-J07 Special Order Option
<b>Number of outputs</b>		1	1	1	1	1	1
<b>GPIO</b>		No	No	No	No	No	No
<b>Output ratings</b>							
Output voltage		10 V	15 V	37.5 V	40 V	56 V	50 V
Output current		200 A	120 A	45 A	50 A	38 A	42 A
<b>Programming accuracy at 25°C <math>\pm 5^\circ</math>C</b>							
Voltage	0.04% +	10 mV	15 mV	37.5 mV	40 mV	60 mV	60 mV
Current	0.1% +	125 mA	90 mA	40 mA	35 mA	28 mA	30 mA
<b>Ripple and noise from 20 Hz to 20 MHz</b>							
Voltage rms		750 $\mu$ V	1.5 mV	800 $\mu$ V	1 mV	1.25 mV	1.25 mV
peak-peak		9 mV	15 mV	9 mV	10.5 mV	11 mV	11 mV
Current rms		200 mA	150 mA	40 mA	40 mA	28 mA	25 mA
<b>Load regulation and line regulation</b>							
Voltage	0.002% +	300 $\mu$ V	650 $\mu$ V	1.2 mV	1.4 mV	2 mV	2 mV
Current	0.005% +	10 mA	7 mA	4 mA	4 mA	2 mA	2 mA
<b>Transient response time</b>		Less than 900 $\mu$ s for the output voltage to recover 100 mV following a change in load from response time 100% to 50% or 50% to 100% of the output current rating of the supply					

## Supplemental Characteristics

(Non-warranted characteristics determined by design and useful in applying the product)

<b>Average resolution</b>							
Voltage		2.5 mV	4 mV	10 mV	10.5 mV	14 mV	12 mV
Current		55 mA	35 mA	15 mA	12.5 mA	9.5 mA	11 mA
OVP		20 mV	30 mV	65 mV	75 mV	100 mV	85 mV
<b>Output voltage programming response time*</b>							
*Full load programming rise/fall time (10% to 90% or 90% to 10%) with full resistive load equal to rated output voltage/rated output current.		35 ms	35 ms	130 ms	130 ms	130 ms	130 ms



# Single-Output: 2000 W (Continued)

## Ordering Information

**Opt 200** 174 to 220 Vac, 47 to 63 Hz  
(Japan only)

**Opt 230** 191 to 250 Vac, 47 to 63 Hz

\* **Opt 908** Rack-mount Kit (p/n 5062-3977)

\* **Opt 909** Rack-mount Kit w/ Handles  
(p/n 5063-9221)

**Opt 0L1** Full documentation on  
CD-ROM, and printed standard  
documentation package

**Opt 0L2** Extra copy of standard  
printed documentation package

**Opt 0B0** Full documentation on  
CD-ROM only

**Opt 0B3** Service Manual

**A line cord option must be specified,  
see the AC line voltage and cord section.**

\* Support rails required

## Accessories

**p/n 1494-0059** Accessory Slide Kit

**E3663AC** Support rails for Agilent  
rack cabinets

## Specifications

(at 0° to 55°C unless  
otherwise specified)

**6575A-  
J04**  
Special Order  
Option

**6575A-  
J06**  
Special Order  
Option

**6575A-  
J07**  
Special Order  
Option

**6575A-  
J08**  
Special Order  
Option

**6575A-  
J09**  
Special Order  
Option

**6575A-  
J11**  
Special Order  
Option

### Number of outputs

1

1

1

1

1

1

### GPIO

No

No

No

No

No

No

### Output ratings

#### Output voltage

160 V

135 V

200 V

100 V

110 V

150 V

#### Output current

13 A

16 A

11 A

22 A

20 A

15 A

### Programming accuracy at 25°C ±5°C

#### Voltage

0.04% +

160 mV

125 mV

200 mV

120 mV

120 mV

150 mV

#### Current

0.1% +

10 mA

12 mA

8 mA

15 mA

13.5 mA

11 mA

### Ripple and noise from 20 Hz to 20 MHz

#### Voltage rms

2.8 mV

2 mV

3.5 mV

1.9 mV

1.9 mV

2.5 mV

#### peak-peak

20 mV

18 mV

25 mV

16 mV

16 mV

18 mV

#### Current rms

18 mA

12 mA

15 mA

15 mA

13.5 mA

12 mA

### Load regulation and line regulation

#### Voltage

0.002%+

6 mV

4 mV

7 mV

4 mV

4 mV

6 mV

#### Current

0.005%+

1 mA

4 mV

1 mA

4 mV

4 mV

1 mA

### Transient response time

Less than 900 µs for the output voltage to recover 100 mV following a change in load from response time 100% to 50% or 50% to 100% of the output current rating of the supply

## Supplemental Characteristics

(Non-warranted characteristics determined by design and useful in applying the product)

### Average resolution

#### Voltage

40 mV

34 mV

50 mV

30 mV

30 mV

37.5 mV

#### Current

3.25 mA

4 mA

2.75 mA

4.5 mA

4.5 mA

3.75 mA

#### OVP

300 mV

242 mV

360 mV

215 mV

215 mV

270 mV

### Output voltage

#### programming response time\*

\*Full load programming rise/fall time (10% to 90% or 90% to 10%) with full resistive load equal to rated output voltage/rated output current.

280 ms

250 ms

350 ms

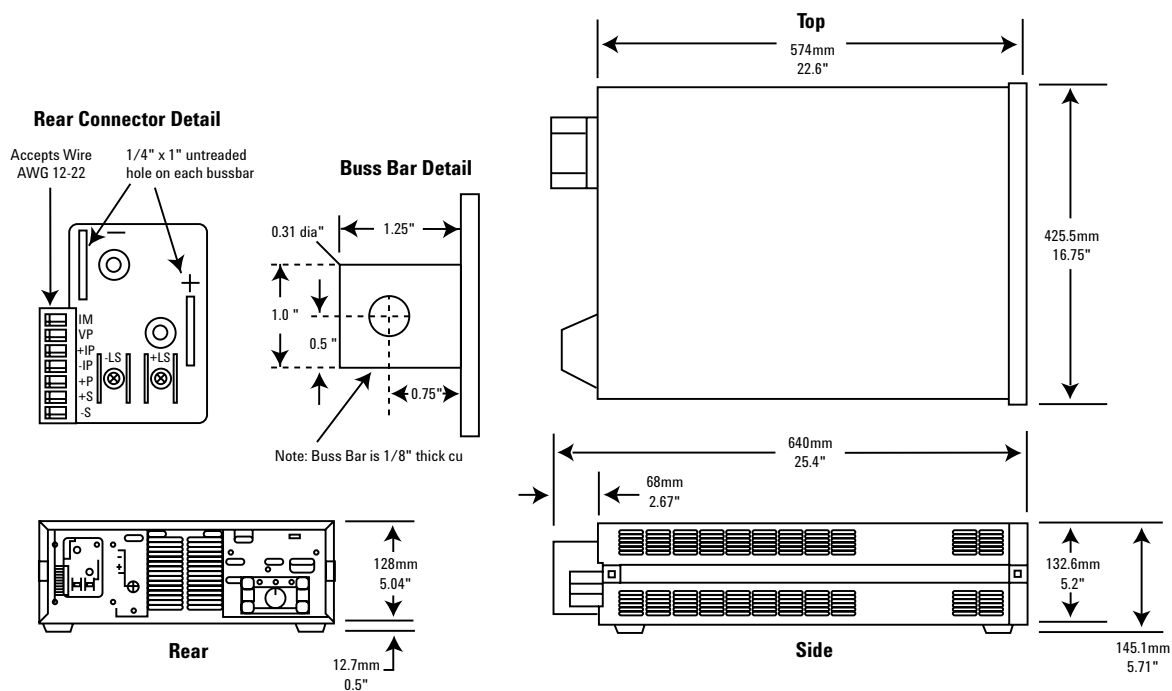
195 ms

195 ms

250 ms

## Single-Output: 2000 W (Continued)

Agilent Models: 6571A, 6572A, 6573A, 6574A, 6575A



More detailed specifications at [www.agilent.com/find/6570](http://www.agilent.com/find/6570)



6680A-6684A

## Single-Output 5000 W GPIB

Low output ripple and noise  
 Selectable compensation for inductive loads  
 Analog control of output voltage and current  
 Fan-speed control to minimize acoustic noise  
 Built-in measurements and advanced programmable features  
 Protection features to ensure DUT safety

### Reliable DC power for manufacturing test and long-term burn-in

This series of 5000 watt DC power supplies has the exceptional, proven reliability that test system engineers look for. It also has the features needed for easy test system integration.

Programming of the DC output and the extensive protection features can be done either from the front panel or using industry standard SCPI commands, via the GPIB. Using the serial link, up to 16 power supplies can be connected through one GPIB address. Test system integration can be further simplified by using the *VXIPlug&Play* drivers. The output voltage and current can also be controlled with analog signals. This is helpful for certain types of noisy environments, and also immediate reactions to process changes.

The 6680A Series has extremely low ripple and noise for a 5000 watt DC power supply. This helps the built-in measurement system make extremely accurate current and voltage measurements.

Selectable compensation is provided for problem-free powering of inductive loads.

### Specifications

(at 0° to 55°C unless otherwise specified)

	6680A	6681A	6682A	6683A	6684A	6680A-J04 Special Order Option
<b>Number of outputs</b>	1	1	1	1	1	1
<b>GPIB</b>	Yes	Yes	Yes	Yes	Yes	Yes
<b>Output ratings</b>						
Voltage	0 to 5 V	0 to 8 V	0 to 21 V	0 to 32 V	0 to 40 V	0 to 3.3 V
Current (40°C then derate linearly 1%/°C from 40°C to 55°C)	0 to 875 A	0 to 580 A	0 to 240 A	0 to 160 A	0 to 128 A	0 to 1000 A
<b>Programming accuracy at 25°C ±5°C</b>						
Voltage 0.04% +	5 mV	8 mV	21 mV	32 mV	40 mV	5 mV
Current 0.1% +	450 mA	300 mA	125 mA	85 mA	65 mA	450 mV
<b>Ripple and noise constant voltage mode from 20 Hz to 20 MHz</b>						
rms	1.5 mV	1.5 mV	1.5 mV	1.0 mV	1.0 mV	3.4 mV
Peak to peak	10 mV	10 mV	10 mV	10 mV	10 mV	15 mV
<b>Readback accuracy at 25°C ±5°C</b>	(percent of reading plus fixed)					
Voltage 0.05% +	7.5 mV	12 mV	32 mV	48 mV	60 mV	7.5 mV
Current 0.1% +	600 mA	400 mA	165 mA	110 mA	90 mA	600 mA
<b>Load and line regulation</b>						
Voltage 0.002% +	0.19 mV	0.3 mV	0.65 mV	1.1 mV	1.5 mV	0.19 mV
Current 0.005% +	65 mA	40 mA	17 mA	12 mA	9 mA	77 mA
<b>Transient response time</b>	Less than 900 μs for the output voltage to recover within 150 mV following a change in load from 100% to 50%, or 50% to 100% of the output current rating of the supply					

### Supplemental Characteristics

(Non-warranted characteristics determined by design that are useful in applying this product)

<b>Ripple and noise constant current mode from 20 Hz to 20 MHz</b>						
rms	290 mA	190 mA	40 mA	28 mA	23 mA	—
<b>Average programming resolution</b>						
Voltage	1.35 mV	2.15 mV	5.7 mV	8.6 mV	10.8 mV	12 mV
Current	235 mA	155 mA	64 mA	43 mA	34 mA	260 mA
OVP	30 mV	45 mV	120 mV	180 mV	225 mV	25 mV
<b>Output voltage programming response time</b>	9 ms	12 ms	45 ms	60 ms	60 ms	9 ms
(excludes command-processing time)	Full-load programming rise or fall time (10 to 90% or 90 to 10%, resistive load)					
<b>Output common-mode noise current</b>						
rms	1.5 mA	1.5 mA	3 mA	3 mA	3 mA	2.0 mA
(to signal-ground peak-to-peak binding post)	10 mA	10 mA	20 mA	20 mA	20 mA	12.5 mA

**Note 1:** Option 6680A-J04 is not available outside the USA because certification process is not complete.

More detailed specifications at [www.agilent.com/find/6680](http://www.agilent.com/find/6680)

## Single-Output: 5000 W GPIB (Continued)

### Application Notes:

**6671A/72A/81A/82A/90A**

**System DC Power Supplies Product Overview**  
5988-3050EN

**Agilent DC Power Supplies  
for Base Station Testing**  
5988-2386EN

**10 Practical Tips You Need to  
Know About Your Power Products**  
5965-8239E

### Supplemental Characteristics for all model numbers

**DC Floating Voltage:** Output terminals can be floated up to  $\pm 60$  Vdc maximum from chassis ground

**Remote Sensing:** Up to half the rated output voltage can be dropped in each load lead. The drop in the load leads subtracts from the voltage available for the load.

**Command Processing Time:** Average time required for the output voltage to begin to change following receipt of digital data is 20 ms for power supplies connected directly to the GPIB

**Modulation:** (analog programming of output voltage and current):

**Input Signal:** 0 to  $-5$  V for voltage, 0 to  $+5$  V for current

**Input Impedance:** 30 k $\Omega$ /or greater

**AC Input (47 to 63 Hz):** 180 to 235 Vac (line-to-line, 3 phase), 27.7 A rms maximum worst case, 21.4 A rms nominal; 360 to 440 Vac, 14.3 A rms maximum worst case, 10.7 A rms nominal (maximum line current includes 5% unbalanced phase voltage condition.) Output voltage derated 5% at 50 Hz and below 200 Vac.

**Input Power:** 7350 VA and 6000 W maximum; 160 W at no load

**GPIB Interface Capabilities:** SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, E1, and C0. IEEE-488.2 and SCPI command set.

### Software Driver:

- IVI-COM
- VXIPlug&Play

**Size:** 425.5 mm W x 221.5 mm H x 674.7 mm D (16.75 in x 8.75 in x 25.56 in)

**Weight:** Net, 51.3 kg (113 lbs); shipping, 63.6 kg (140 lbs)

**Warranty Period:** One year

### Ordering Information

**Opt 208** 180 to 235 Vac, 3 phase, 47 to 63 Hz

**Opt 400** 360 to 440 Vac, 3 phase, 47 to 63 Hz

**Opt 602** Two Bus Bar Spacers for paralleling power supplies (p/n 5060-3514)

\* **Opt 908** Rack-mount Kit (p/n 5062-3977 and p/n 5062-3974)

\* **Opt 909** Rack-mount Kit with Handles (p/n 5063-9221 and p/n 5063-9219).

**Opt 0L1** Full documentation on CD-ROM, and printed standard documentation package

**Opt 0L2** Extra copy of standard printed documentation package

**Opt 0B0** Full documentation on CD-ROM only

**Opt 0B3** Service Manual

\* Support rails required

### Accessories

**p/n 5060-3513** Three 30-A Replacement Fuses for 180 to 235 Vac line

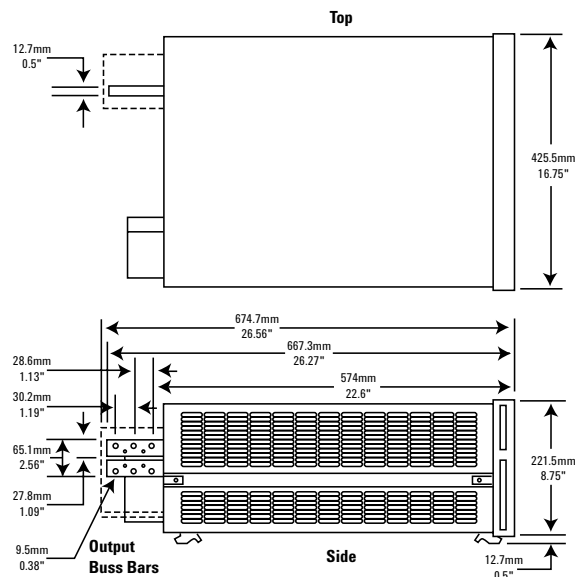
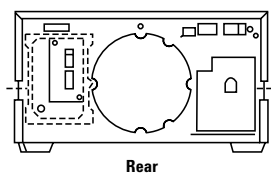
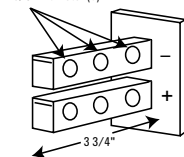
**p/n 5060-3512** Three 16-A Replacement Fuses for 360 to 440 Vac line

**E3663AC** Support rails for Agilent rack cabinets

**p/n 5080-2148** Serial link cable 2m (6.6 ft.)

**Agilent Models: 6680A, 6681A, 6682A, 6683A, 6684A**

**Bus Bar Detail**  
3/8" Diameter (6)





6690A-6692A

## Single-Output 6600 W GPIB

- Low output ripple and noise
- Analog control of output voltage and current
- Fan-speed control to minimize acoustic noise
- Built-in measurements and advanced programmable features
- Protection features to ensure DUT safety

### Reliable DC power for manufacturing test and long-term burn-in

This series of 6600 watt DC power supplies has the exceptional, proven reliability that test system engineers look for. It also has the features needed for easy test system integration.

Programming of the DC output and the extensive protection features can be done either from the front panel or using industry standard SCPI commands, via the GPIB. Using the serial link, up to 16 power supplies can be connected through one GPIB address. Test system integration can be further simplified by using the *VXIPlug&Play* drivers. The output voltage and current can also be controlled with analog signals. This is helpful for certain types of noisy environments, and also immediate reactions to process changes.

The 6690A Series has extremely low ripple and noise for a 6600 watt DC power supply. This helps the built-in measurement system make extremely accurate current and voltage measurements.

### Specifications

(at 0° to 55°C unless otherwise specified)

	6690A	6691A	6692A
<b>Number of outputs</b>	1	1	1
<b>GPIB</b>	Yes	Yes	Yes
<b>Output ratings</b>			
Voltage	0 to 15 V	0 to 30 V	0 to 60 V
Current (derated linearly 1%/°C from 40°C to 55°C)	0 to 440 A	0 to 220 A	0 to 110 A
<b>Programming accuracy at 25°C ±5°C</b>			
Voltage 0.04% +	15 mV	30 mV	60 mV
Current 0.1% +	230 mA	125 mA	65 mA
<b>Ripple and noise constant voltage mode from 20 Hz to 20 MHz</b>			
rms	2.5 mV	2.5 mV	2.5 mV
Peak to peak	15 mV	25 mV	25 mV
<b>Readback accuracy at 25°C ±5°C (percent of reading plus fixed offset) System models only</b>			
Voltage 0.05% +	22.5 mV	45 mV	90 mV
Current 0.1% +	300 mA	165 mA	80 mA
<b>Load regulation</b>			
Voltage 0.002% +	0.65 mV	1.1 mV	2.2 mV
Current 0.005% +	40 mA	17 mA	9 mA
<b>Line regulation</b>			
Voltage 0.002% +	0.65 mV	0.65 mV	0.65 mV
Current 0.005% +	40.5 mA	17 mA	9 mA
<b>Transient response time</b>	Less than 900 µs for the output voltage to recover within 150 mV following a change in load from 100% to 50%, or 50% to 100% of the output current rating of the supply		

### Application Notes:

**6671A/72A/81A/82A/90A  
System DC Power Supplies Product Overview**  
5988-3050EN

**Using Agilent 6690A Series System  
DC Power Supplies for Testing  
Data Storage Control Boards**  
(PN 6690A-1)  
5988-3062EN

**Using Agilent 6690A Series System DC Power  
Supplies for Automobile Battery Simulation**  
(PN 6690A-2)  
5988-3061EN

More detailed specifications at [www.agilent.com/find/6690](http://www.agilent.com/find/6690)

# Single-Output: 6600 W GPIB (Continued)

## Specifications

(at 0° to 55° C unless otherwise specified)

6690A

6691A

6692A

## Supplemental Characteristics for all model numbers

**DC Floating Voltage:** Output terminal can be floated up to  $\pm 60$  Vdc from chassis ground

**Remote Sensing:** Up to half the rated output voltage can be dropped in each load lead. The drop in the load leads subtracts from the voltage available at the load.

**Command Processing Time:** Average time required for the output voltage to begin to change following receipt of digital data is 20 ms for power supplies connected directly to the GPIB.

**Modulation:** (analog programming of output voltage and current):

**Input Signal:** 0 to -5 V for voltage, and 0 to +5 V for current.

**Input Impedance:** 30 k $\Omega$  or greater.

**AC Input (47 to 63 Hz):** 180 to 235 Vac (line-to-line 3 phase) 36 A rms maximum worst case, 28 A rms nominal; 360 to 440 Vac, 18 A rms maximum worst case, 14 A rms nominal. (Maximum line current includes 5% unbalanced phase voltage condition).

### Software Driver:

- IVI-COM
- VXIPlug&Play

**Input Power:** 9000 VA and 7950 W maximum; 175 W at no load.

**Size:** 425.5 mm W x 221.5 mm H x 674.7 mm D (16.75 in x 8.75 in x 25.56 in).

**Warranty Period:** One year

## Ordering Information

**Opt 208** 180 to 235 Vac, 3 phase, 47 to 63 Hz

**Opt 400** 360 to 440 Vac, 3 phase, 47 to 63 Hz

**Opt 602** Two Bus Bar Spacers for paralleling power supplies (p/n 5060-3514)

\* **Opt 908** Rack-mount Kit (p/n 5062-3977 and p/n 5063-9212)

\* **Opt 909** Rack-mount Kit with Handles (p/n 5063-9221 and p/n 5063-9219).

## Supplemental Characteristics

(Non-warranted characteristics determined by design that are useful in applying this product)

Ripple and noise constant current mode from 20 Hz to 20 MHz				
	rms	200 mA	50 mA	30 mA
Average programming resolution				
Voltage		4.1 mV	8.1 mV	16 mV
Current		118.5 mA	59 mA	30 mA
OVP		90 mV	170 mV	330 mV
Output voltage programming response time (excludes command-processing time)				
Full-load programming rise or fall time (10 to 90% or 90 to 10%, resistive load)		45 ms	60 ms	100 ms
Output common-mode noise current				
rms		3 mA	3.5 mA	4 mA
peak-to-peak (to signal-ground binding post)		20 mA	20 mA	25 mA

**Opt 0L1** Full documentation on CD-ROM, and printed standard documentation package

**Opt 0L2** Extra copy of standard printed documentation package

**Opt 0B0** Full documentation on CD-ROM only

**Opt 0B3** Service Manual

\* Support rails required

## Accessories

**p/n 5065-6935** Replacement fuse kit for 360-440 Vac line.

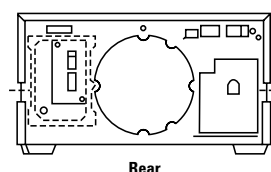
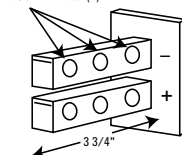
**p/n 5065-6934** Replacement fuse kit for 180-235 Vac line.

**E3663AC** Support rails for Agilent rack cabinets.

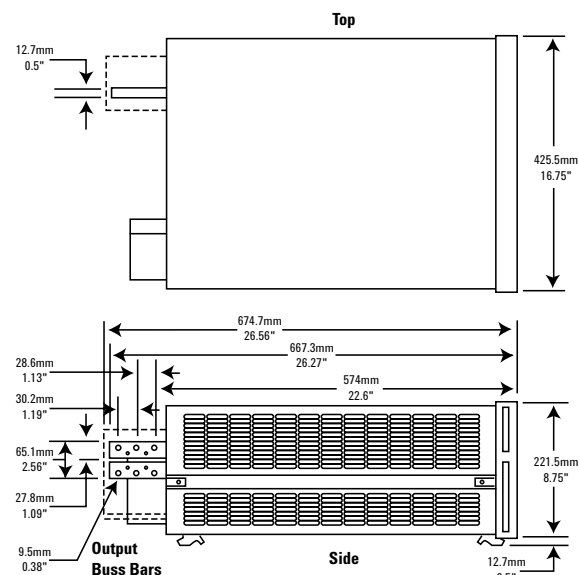
**p/n 5080-2148** Serial link cable 2m (6.6 ft.)

## Agilent Models: 6690A, 6691A, 6692A

**Bus Bar Detail**  
3/8" Diameter (6)



Rear



More detailed specifications at [www.agilent.com/find/6690](http://www.agilent.com/find/6690)



6621A-6624A, 6627A

## Multiple-Output 40 W-105 W GPIB

Up to four fully isolated power supplies in a 3 U package

Dual-range outputs

Fast, low-noise outputs

Built-in measurements and advanced programmable features

Protection features to ensure DUT safety

Two, three, or four isolated outputs are integrated into one package, conserving rack space and GPIB addresses. Most of the outputs also provide dual ranges, for more current at lower voltage levels. The outputs can be connected in parallel or series to further increase the flexibility that these products offer the system designer.

Programming is done using industry standard SCPI commands. Test system integration can be further simplified by using the *VXIPlug&Play* drivers. These power supplies help reduce test time with fast up and down programming, which is enhanced by an active downprogrammer which can sink the full rated current.

### Application Notes:

**10 Practical Tips You Need to Know About Your Power Products**  
5965-8239E

**10 Hints for Using Your Power Supply to Decrease Test Time**  
5968-6359E

**Understanding Linear Power Supply Operation**  
(AN1554)  
5989-2291EN

**Modern Connectivity - Using USB and LAN I/O Converters**  
(AN 1475-1)  
5989-0123EN

Specifications (at 0° to 55° C unless otherwise specified)		40 W output	40 W output	80 W output	80 W output	105 W output
Output power	Low-range volts, amps	0 to 7 V, 0 to 5 A	0 to 20 V, 0 to 2 A	0 to 7 V, 0 to 10 A	0 to 20 V, 0 to 4 A	0-35 V, 0-3 A
	High range volts, amps	0 to 20 V, 0 to 2 A	0 to 50 V, 0 to 0.8 A	0 to 20 V, 0 to 4 A	0 to 50 V, 0 to 2 A	—
Output combinations for each model (total number of outputs)						
6621A (2)		—	—	2	—	—
6622A (2)		—	—	—	2	—
6623A (3)		1	1	1	—	—
6624A (4)		2	2	—	—	—
6627A (4)		—	4	—	—	—
6623A(3) Special Order Option J03		—	2	—	—	1
Programming accuracy	Voltage	19 mV + 0.06%	50 mV + 0.06%	19 mV + 0.06%	50 mV + 0.06%	35 mV + 0.06%
	Current	50 mA + 0.16%	20 mA + 0.16%	100 mA + 0.16%	40 mA + 0.16%	30 mA + 0.16%
Readback accuracy (at 25°C ±5°C)	Voltage	20 mV + 0.05%	50 mV + 0.05%	20 mV + 0.05%	50 mV + 0.05%	35 mV + 0.05%
	+Current	10 mA + 0.1%	4 mA + 0.1%	20 mA + 0.1%	8 mA + 0.1%	6 mA + 0.1%
	-Current	25 mA + 0.2%	8 mA + 0.2%	50 mA + 0.2%	20 mA + 0.2%	15 mA + 0.2%
Ripple and noise (peak-to-peak, 20 Hz to 20 MHz; rms, 20 Hz to 10 MHz)						
Constant voltage rms		500 µV	500 µV	500 µV	500 µV	500 µV
peak-to-peak		3 mV	3 mV	3 mV	3 mV	3 mV
Constant current rms		1 mA	1 mA	1 mA	1 mA	1 mA
Load regulation	Voltage	2 mV	2 mV	2 mV	2 mV	2 mV
	Current	1 mA	0.5 mA	2 mA	1 mA	2 mA
Load cross regulation	Voltage	1 mV	2.5 mV	1 mV	2.5 mV	N/A
	Current	1 mA	0.5 mA	2 mA	1 mA	N/A
Line regulation	Voltage	0.01% + 1 mV	0.01% + 1 mV	0.01% + 1 mV	0.01% + 1 mV	0.01% + 1 mV
	Current	0.06% + 1 mA	0.06% + 1 mA	0.06% + 1 mA	0.06% + 1 mA	0.06% + 1 mA

**Transient response time** Less than 75 µs for the output to recover to within 75 mV of nominal value following a load change within specifications

More detailed specifications at [www.agilent.com/find/6620](http://www.agilent.com/find/6620)

## Multiple-Output: 40 W-105 W GPIB (Continued)

## Specifications

(at 0° to 55°C unless otherwise specified)

40 W  
output40 W  
output80 W  
output80 W  
output105 W  
outputSupplemental Characteristics  
for all model numbers

**DC Floating Voltage:** All outputs can be floated up to  $\pm 240$  Vdc from chassis ground

**Remote Sensing:** Up to 1 V drop per load lead. The drop in the load leads is subtracted from the voltage available for the load.

**Command Processing Time:** 7 ms typical with front-panel display disabled

**Down Programming:** Current sink limits are fixed approximately 10% higher than source limits for a given operating voltage above 2.5 V

**Input Power:** 550 W max., 720 VA max.

**GPIB Interface Capabilities:** SH1, AH1, T6, L4, SR1, RL1, PP1, DC1, DT0.

**Software Driver:**  
VXIPlug&Play

**Regulatory Compliance:** Listed to UL1244; conforms to IEC 61010-1; carries the CE mark.

**Size:** 425.5 mm W x 132.6 mm H x 497.8 mm D (16.75 in x 5.22 in x 19.6 in)

**Weight:** Net, 17.4 kg (38 lb); shipping, 22.7 kg (50 lb)

**Warranty Period:** One year

## Ordering Information

**Opt 100** 87 to 106 Vac, 47 to 66 Hz Input, 6.3 A (Japan only)

**Opt 120** 104 to 127 Vac, 47 to 63 Hz

**Opt 220** 191 to 233 Vac, 47 to 66 Hz, 3.0 A

**Opt 240** 209 to 250 Vac, 47 to 66 Hz, 3.0 A

**Opt 750** Relay Control and DFI/RI

**Opt S50** similar to option 750, however the remote inhibit does not latch

\* **Opt 908** Rack-mount Kit (p/n 5062-3977)

\* **Opt 909** Rack-mount Kit w/Handles (p/n 5063-9221)

**Opt 0L1** Full documentation on CD-ROM, and printed standard documentation package

## Supplemental Characteristics

(Non-warranted characteristics determined by design and useful in applying the product)

Average programming resolution	Voltage	6 mV	15 mV	6 mV 20 mV (high)	6 mV 20 mV (high)	10.5 mV
	Current	25 mA	10 mA	50 mA 20 mA (high)	50 mA 20 mA (high)	15 mA
OVP		100 mV	250 mV	100 mV 2	50 mV	175 mV
Output programming response time (time to settle within 0.1% of full scale output, after Vset command has been processed)		2 ms	6 ms	2 ms	6 ms	6 ms

**Opt 0L2** Extra copy of standard printed documentation package

**Opt 0B0** Full documentation on CD-ROM only

**Opt 0B3** Service Manual

\* Support rails required

## Accessories

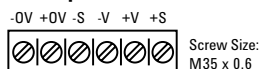
p/n 1494-0059 Rack Slide Kit

**E3663A** Support rails for Agilent rack cabinets

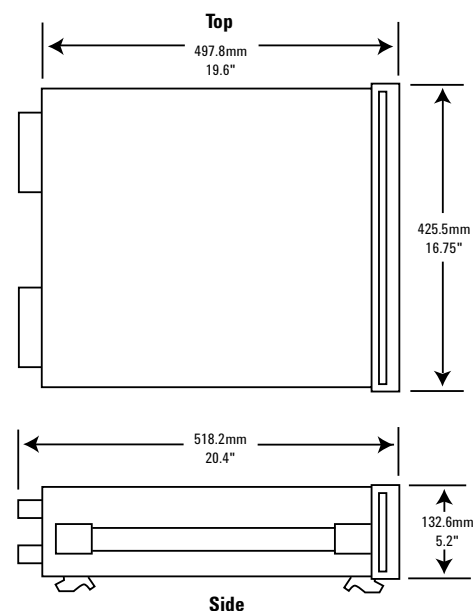
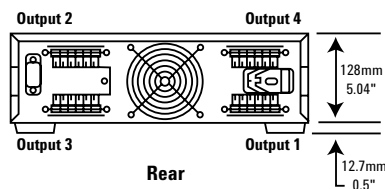
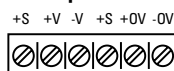
## Agilent Models: 6621A, 6622A, 6623A, 6624A, 6627A

## Terminal Strip Detail

## Output 2 &amp; 3



## Output 1 &amp; 4







6625A, 6626A, 6628A, 6629A

## Precision Multiple-Output 25 W-50 W GPIB

Up to four fully isolated power supplies in a 3 U package

Fast, low-noise outputs

Dual-range, precision low current measurement

Built-in measurements and advanced programmable features

Protection features to ensure DUT safety

Two or four isolated outputs are integrated into one package, conserving rack space and GPIB addresses. Dual ranges allow for more current at lower voltage levels. The outputs can be connected in parallel or series to further increase the flexibility that these products offer the system designer. Programming is done using industry standard SCPI commands and test system integration can be further simplified by using the *VXIPlug&Play* drivers. These power supplies help reduce test time with fast up and down programming, which is enhanced by the active down-programmer which can sink the full rated current.

These power supplies are very useful on the R&D bench. The accuracy of both the programming and the measurement systems allow precise control and monitoring of prototype bias power. The extensive protection features protect valuable prototypes, including very fast CV/CC crossover. The power supply can be controlled from either the front panel keypad or, for automated testing, from the GPIB.

### Specifications

(at 0° to 55°C unless otherwise specified)

Specifications (at 0° to 55°C unless otherwise specified)		25 W output	50 W output
Output power	Low-range volts, amps	0 to 7 V, 0 to 15 mA	0 to 16 V, 0 to 200 mA
	High range volts, amps	0 to 50 V, 0 to 500 mA	0 to 50 V, 0 to 1 A or 0 to 16 V, 0 to 2 A
Output combinations for each model (total number of outputs)	6625A (2) Precision	1	1
	6626A (4) Precision	2	2
	6628A (2) Precision	—	2
	6629A (4) Precision	—	4
Programming accuracy (at 25°C ±5°C)	Voltage	1.5 mV + 0.016% (low) 10 mV + 0.016% (high)	3 mV + 0.016% (low) 10 mV + 0.016% (high)
	Current	15 µA + 0.04% (low) 100 µA + 0.04% (high)	185 µA + 0.04% (low) 500 µA + 0.04% (high)
Readback accuracy (at 25°C ±5°C)	Voltage	0.016% + 2 mV (low) 0.016% + 10 mV (high)	0.016% + 3.5 mV (low) 0.016% + 10 mV (high)
	+/-Current	0.03% + 15 µA (low) 0.03% + 130 µA (high)	0.04% + 250 µA (low) 0.04% + 550 µA (high)
Ripple and noise (peak-to-peak, 20 Hz to 20 MHz; rms, 20 Hz to 10 MHz)	Constant voltage rms	500 µV	500 µV
	peak-to-peak	3 mV	3 mV
	Constant current rms	0.1 mA	0.1 mA
Load regulation	Voltage	0.5 mV	0.5 mV
	Current	0.005 mA	0.01 mA
Load cross regulation	Voltage	0.25 mV	0.25 mV
	Current	0.005 mA	0.01 mA
Line regulation	Voltage	0.5 mV	0.5 mV
	Current	0.005 mA	0.01 mA
Transient response time change within specifications		Less than 75 µs for the output to recover to within 75 mV of nominal value following a load	
Supplemental Characteristics		(Non-warranted characteristics determined by design and useful in applying the product)	
		25-watt output	50-watt output
Average programming resolution	Voltage	460 µV (low)	1 mV (low)
		3.2 mV (high)	3.2 mV (high)
	Current	1 µA (low)	13 µA (low)
		33 µA (high)	131 µA (high)
	OVP	230 mV	230 mV
Output programming response time (time to settle within 0.1% of full scale output, after Vset command has been processed)		6 ms	6 ms

More detailed specifications at [www.agilent.com/find/6620](http://www.agilent.com/find/6620)

## Precision Multiple-Output: 25 W-50 W GPIB (Continued)

### Application Notes:

**10 Practical Tips You Need to Know About Your Power Products**  
5965-8239E

**10 Hints for Using Your Power Supply to Decrease Test Time**  
5968-6359E

**Understanding Linear Power Supply Operation**  
(AN1554)  
5989-2291EN

**Modern Connectivity - Using USB and LAN I/O Converters**  
(AN 1475-1)  
5989-0123EN

### Supplemental Characteristics for all model numbers

**DC Floating Voltage:** All outputs can be floated up to  $\pm 240$  Vdc from chassis ground

**Remote Sensing:** Up to 10 V drop per load lead. The drop in the load leads is subtracted from the voltage available for the load.

**Command Processing Time:** 7 ms typical with front-panel display disabled

**Input Power:** 550 W max., 720 VA max.

**GPIB Interface Capabilities:** SH1, AH1, T6, L4, SR1, RL1, PP1, DC1, DT0, C0, E1.

**Software Driver:**  
VXIPlug&Play

**Regulatory Compliance:** Listed to UL 1244; conforms to IEC 61010-1.

**Size:** 425.5 mm W x 132.6 mm H x 497.8 mm D (16.75 in x 5.22 in x 19.6 in)

**Weight:** 6626A, 6629A: Net, 17.4 kg (38 lb); shipping, 22.7 kg (50 lb) 6625A, 6628A: Net, 15.5 kg (34 lb); shipping, 20.8 kg (46 lb)

**Warranty Period:** One year

### Ordering Information

**Opt 100** 87 to 106 Vac, 47 to 66 Hz Input, 6.3 A (Japan only)

**Opt 120** 104 to 127 Vac, 47 to 63 Hz

**Opt 220** 191 to 233 Vac, 47 to 66 Hz, 3.0 A

**Opt 240** 209 to 250 Vac, 47 to 66 Hz, 3.0 A

**Opt 750** Relay Control and DFI/RI

**Opt S50** Similar to option 750, however the remote inhibit does not latch

\* **Opt 908** Rack-mount Kit (p/n 5062-3977)

\* **Opt 909** Rack-mount Kit w/Handles (p/n 5063-9221)

**Opt 0L1** Full documentation on CD-ROM, and printed standard documentation package

**Opt 0L2** Extra copy of standard printed documentation package

**Opt 0B0** Full documentation on CD-ROM only

**Opt 0B3** Service Manual

\* Support rails required

### Accessories

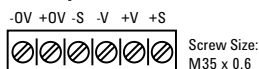
**p/n 1494-0059** Rack Slide Kit

**E3663AC** Support rails for Agilent rack cabinets

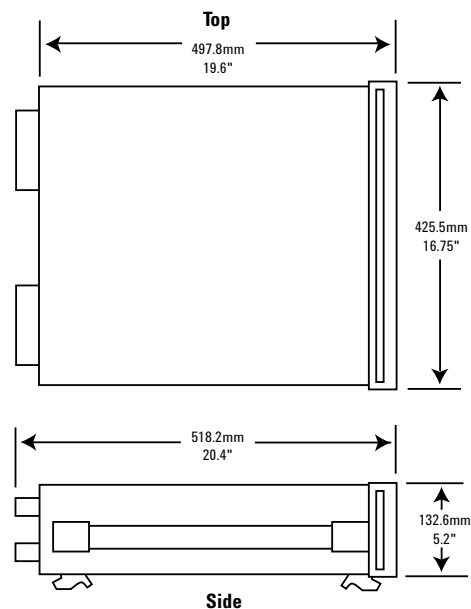
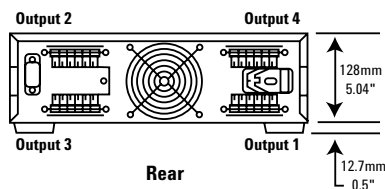
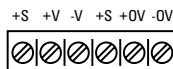
### Agilent Models: 6625A, 6626A, 6628A, 6629A

#### Terminal Strip Detail

##### Output 2 & 3



##### Output 1 & 4



# Low-Profile Modular Power System

## 50-100 W GPIB, LAN, USB



N6700B, N6710B, N6731-36B, N6741B-46B,  
N6751A-52A, N6761A-62A

Small size: up to 4 outputs in 1 U of rack space

16 DC power modules: basic, performance and precision models

Fast output programming with active downprogramming

Ultra fast command processing time

Output sequencing and advanced triggering system

Optional LIST mode, built-in digitizer and disconnect relays



The Agilent N6700 Low-Profile Modular Power System (MPS) is a switching regulated, multiple-output programmable DC power supply system with the performance of a linear power supply. The N6700 is a flexible modular platform that allows you to mix and match 16 different DC power modules to create a 1- to 4-channel DC power system to optimized performance, power and price to match test needs. Test system engineers can invest in high-performance outputs where speed and accuracy are needed, or purchase basic performance outputs for simple DC power requirements.

### Small Size

The Agilent N6700 MPS uses an advanced switching power supply design that fits within 1U of rack space. It has side air vents (no top or bottom air vents) so other instruments can be mounted directly above or below it. (Requires rack mount kit)

### Protection Features

Each N6700 module is protected against over-voltage, over-current, and over-temperature. A fault condition in one module can be detected within 10 microseconds by other modules so that they can be quickly shut down to avoid hazardous conditions on your DUT.

## Specifications

(at 0° to 55°C, and  
derated above 40°C)

	N6751A	N6752A	N6761A	N6762A
<b>Output Ratings</b>				
Voltage	50 V	50 V	50 V	50 V
Current	5 A	10 A	1.5 A	3 A
Power	50 W	100 W	50 W	100 W
<b>Programming Accuracy</b> (at 23°C ±5°C)				
Voltage high range	0.06% + 19 mV	0.006% + 19 mV	0.016% + 6 mV	0.016% + 6 mV
Voltage low range (≤ 5.5 V)	N/A	N/A	0.016% + 1.5 mV	0.016% + 1.5 mV
Current high range	0.1% + 20 mA	0.1% + 20 mA	0.04% + 200 µA	0.04% + 200 µA
Current low range	≤ 100 mA, @ 0 - 7 V	N/A	N/A	0.04% + 15 µA
	≤ 100 mA, @ 0 - 50 V	N/A	N/A	0.04% + 55 µA
<b>Readback Accuracy</b> (at 23°C ±5°C)				
Voltage high range	0.05% + 20 mV	0.05% + 20 mV	0.016% + 6 mV	0.016% + 6 mV
Voltage low range	≤ 5.5 V	N/A	0.016% + 1.5 mV	0.016% + 1.5 mV
Current high range	0.1% + 4 mA	0.1% + 4 mA	0.04% + 160 µA	0.04% + 160 µA
Current low range	≤ 100 mA, @ 0 - 7 V <sup>2</sup>	N/A	N/A	0.03% + 15 µA
	≤ 100 mA, @ 0 - 50 V	N/A	N/A	0.03% + 55 µA
<b>Output Ripple and Noise (PARD)</b> (from 20 Hz to 20 MHz)				
CV peak-to-peak <sup>1</sup>	6 mV	6 mV	6 mV	6 mV
CV rms	1 mV	1 mV	1 mV	1 mV
<b>Load Regulation</b>				
Voltage	2 mV	2 mV	0.5 mV	0.5 mV
Current	2 mA	2 mA	65 µA	65 µA
<b>Line Regulation</b>				
Voltage	1 mV	1 mV	0.5 mV	0.5 mV
Current	1 mA	1 mA	30 µA	30 µA

<sup>1</sup> For typical values, refer to Supplemental Characteristics.

<sup>2</sup> Applies when measuring 4006 data points (SENSe:SWEp:POINts = 4096).

More detailed specifications at [www.agilent.com/find/N6700](http://www.agilent.com/find/N6700)

## Low-Profile Modular Power System

### 50-100 W GPIB (Continued)

#### Specifications

(at 0° to 55°C, and derated above 40°C)

N6751A N6752A N6761A N6762A

#### Connectivity

The N6700 offers many system oriented features to simplify and accelerate test system development. They support the industry standard SCPI commands and come standard with software drivers.

The N6700 MPS comes standard with GPIB, USB 2.0, and 10/100 Base-T Ethernet LAN interfaces. While GPIB is best suited for use with existing systems, Agilent offers USB and LAN to allow you to take advantage of the availability, speed, and ease-of-use of common computer industry standard interfaces.

The N6700 contains a web server that provides web pages for monitor, control and setup of the MPS.

#### Output Sequencing

Each DC power module can be individually set to turn on or to turn off with a delay. By adjusting the delay times and then commanding the N6700 to turn on/off, you can set the N6700 modules to sequence on/off in a particular order.

#### Programmable Voltage Slew

For some applications, like inrush limiting or powering rate-sensitive devices, it is necessary to slow down and control the speed of the power supply to maintain a specific voltage slew rate. The N6700 provides programmable voltage slew rate, so that with a single command, you can generate a zero to full-scale voltage change controllable from 1 millisecond to 10 seconds.

**Transient Response Time** (time to recover to within the settling band following a load change)

from 60% to 100% and from 100% to 60% of full load for models N6751A & N6761A

from 50% to 100% and from 100% to 50% of full load for models N6752A & N6762A

Voltage settling band	± 75 mV	± 75 mV	± 75 mV	± 75 mV
Time	< 100 µs	< 100 µs	< 100 µs	< 100 µs

#### Supplemental Characteristics

(Non-warranted characteristics determined by design that are useful in applying the product)

Programming Resolution				
Voltage high range	3.5 mV	3.5 mV	880 μV	880 μV
Voltage low range (≤ 5.5 V)	N/A	N/A	90 μV	90 μV
Current high range	3.25 mA	3.25 mA	60 μA	60 μA
Current low range (≤ 0.1 A)	N/A	N/A	2 μA	2 μA
Output Ripple and Noise (PARD)				
Typical CV peak-to-peak	4 mV	4 mV	4 mV	4 mV
CC rms	2 mA	2 mA	2 mA	2 mA
Over-voltage Protection				
Accuracy	0.25% + 250 mV	0.25% + 250 mV	0.25% + 250 mV	0.25% + 250 mV
Response Time	50 μs from occurrence of 0V condition to start of output shutdown			
Down-programming Capability				
Continuous power	7 W	7 W	7 W	7 W
Peak current	7 A	7 A	3.8 A	3.8 A
Modules can discharge a 1000 μF capacitor from 50 V to 0 V at a rate of 4 times/second.				
Maximum Up-programming Time with full resistive load: (time from 10% to 90% of total voltage excursion)				
Voltage setting from 0 V to 10 V	0.2 ms	0.2 ms	0.6 ms	0.6 ms
Voltage setting from 0 V to 50 V	1.5 ms	1.5 ms	2.2 ms	2.2 ms
Maximum Up-programming Settling Time with full resistive load: (time from start of voltage change to within 50 mV of final value)				
Voltage setting from 0 V to 10 V	0.5 ms	0.5 ms	0.9 ms	0.9 ms
Voltage setting from 0 V to 50 V	4.0 ms	4.0 ms	4.0 ms	4.0 ms
Maximum Down-programming Time with no load: (time from start of voltage change to output voltage <0.5 V)				
Voltage setting from 10 V to 0 V	0.3 ms	0.3 ms	0.3 ms	0.3 ms
Voltage setting from 50 V to 0 V	1.3 ms	1.3 ms	1.3 ms	1.3 ms
Maximum Down-programming Settling Time with no load: (time from start of voltage change to within 50 mV of final value)				
Voltage setting from 10 V to 0 V	0.45 ms	0.45 ms	0.45 ms	0.45 ms
Voltage setting from 50 V to 0 V	1.4 ms	1.4 ms	1.4 ms	1.4 ms
Down-programming with 1000 μF load: <sup>2</sup> (time from start of voltage change to output voltage <0.5 V)				
Voltage setting from 10 V to 0 V	2.1 ms	2.1 ms	4.5 ms	4.5 ms
Voltage setting from 50 V to 0 V	11 ms	11 ms	23 ms	23 ms
Down-programming Capability:				
Continuous power	7 W	7 W	7 W	7 W
Peak current	7 A	7 A	3.8 A	3.8 A

<sup>2</sup>Modules can discharge a 1000 µF capacitor from 50 V to 0 V at a rate of 4 times/second

More detailed specifications at [www.agilent.com/find/N6700](http://www.agilent.com/find/N6700)

## Low-Profile Modular Power System

### 50-100 W GPIB (Continued)

#### Specifications

(at 0° to 55°C, and derated above 40°C)

#### Output Ratings

Voltage	5 V	8 V	20 V	35 V	60 V	100 V
Current	10 A	6.25 A	2.5 A	1.5 A	0.8 A	0.5 A
Power	50 W	50 W	50 W	50 W	50 W	50 W

#### Programming Accuracy<sup>2</sup> (at 23°C ±5°C)

Voltage	0.1% + 19 mV	0.1% + 19 mV	0.1% + 20 mV	0.1% + 35 mV	0.1% + 60 mV	0.1% + 100 mV
Current	0.15% + 20 mA	0.15% + 20 mA	0.15% + 20 mA	0.15% + 20 mA	0.15% + 20 mA	0.15% + 10 mA

#### Readback Accuracy (at 23°C ±5°C)

Voltage	0.1% + 20 mV	0.1% + 20 mV	0.1% + 20 mV	0.1% + 35 mV	0.1% + 60 mV	0.1% + 100 mV
Current	0.15% + 20 mA	0.15% + 10 mA	0.15% + 5 mA	0.15% + 4 mA	0.15% + 4 mA	0.15% + 2 mA

#### Output Ripple and Noise (PARD) (from 20 Hz – 20 MHz)

CV peak-to-peak	10 mV	12 mV	14 mV	15 mV	25 mV	30 mV
CV rms	2 mV	2 mV	3 mV	5 mV	9 mV	18 mV

#### Load Regulation<sup>1</sup>

Voltage	5 mV	6 mV	9 mV	11 mV	13 mV	20 mV
Current	2 mA	2 mA	2 mA	2 mA	2 mA	2 mA

#### Line Regulation

Voltage	1 mV	2 mV	2 mV	4 mV	6 mV	10 mV
Current	1 mA	1 mA	1 mA	1 mA	1 mA	1 mA

#### Transient Response Time

(time to recover to within the settling band following a load change from 50% to 100% and from 100% to 50% of full load.)

Voltage settling band	± 80 mV	± 80 mV	± 200 mV	± 200 mV	± 400 mV	± 500 mV
Time	200 µs	200 µs	200 µs	200 µs	200 µs	200 µs

<sup>1</sup> With an output change from no load to full load, up to a maximum load-lead drop of 1 V per lead.

<sup>2</sup> Applies from minimum to maximum programming range. (see Supplemental Characteristics)

#### Series and Parallel Operation

To increase the available power, similarly rated outputs can be operated in series for greater output voltage or in parallel for greater output current.

To simplify parallel operation, the N6700 offers virtual channels, a firmware based feature that allows the N6700 system to treat up to 4 channels as a single, synchronized channel. Once configured, all functions (sourcing, measurements, triggering, protection, and status monitoring) behave as if there is 1 channel of up to 4 times the capacity of a single channel, without writing a single line of code to manage the interaction and synchronization of the paralleled power supplies.

#### Triggering

The N6700B Low-Profile MPS mainframe has hardware trigger in/trigger out signals which permit the N6700 to be synchronized with external events.

#### Output Disconnect Relays

Each module in the N6700 can be individually ordered with optional Output Disconnect Relays. These relays disconnect both the plus and minus side of the power supply, including the sense leads.

#### Universal AC Input

The N6700 has a universal input that operates from 100-240 Vac, 50/60/400 Hz. There are no switches to set or fuses to change when switching from one voltage standard to another. The AC input employs power factor correction.

#### Choosing the right DC Power Modules to meet your ATE needs

##### N6750 Family

The Agilent N6750 family of high-performance, autoranging DC power modules provides low noise, high accuracy and includes, autoranging output capabilities enabling one power supply to do the job of several traditional power supplies. In addition, it includes optional high-speed test extensions that offers an oscilloscope-like digitizer and ultra-fast programming speed.

##### N6760 Family

The Agilent N6760 family of precision DC power modules provides precise control and measurements in the milliamper and microampere region with the ability to simultaneously digitize voltage and current, and capture those measurements in an oscilloscope-like data buffer. These precision DC power modules offer dual ranges on both programming and measurement and are ideally suited for semiconductor and passive device testing.

More detailed specifications at [www.agilent.com/find/N6700](http://www.agilent.com/find/N6700)

## Low-Profile Modular Power System

### 50-100 W GPIB (Continued)

#### Specifications

(at 0° to 55°C, and derated above 40°C)

N6731B	N6732B	N6733B	N6734B	N6735B	N6736B
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#### N6750/60 Low Noise Outputs

This switching power supply outperforms most linear power supplies on the market with low normal and common mode noise.

#### N6750/60 Output Programming Speed

The N6750/60 achieves performance unlike a typical DC power supply with up to 10 to 50 times faster than other programmable power supplies. Thanks to an active down-programming circuit to rapidly pull down the output when lowering the module's output voltage, the N6750/60 can rapidly program both up and down in voltage. These output speeds allow the N6750/60 to give maximum system throughput when your test calls for frequent changes in power supply voltage settings.

#### N6750/60 Autoranging for Flexibility

The N6750/60 gives test system designers even more flexibility by providing autoranging outputs. This autoranging capability provides maximum output power at any output voltage up to 50 V. This allows one power supply to do the job of several power supplies because its operating range covers low voltage, high current as well as high voltage, low current operating points.

#### N6750/60 High-Speed Test Extensions

To make your testing go even faster, the N6750/60 offer High-Speed Test Extensions (HSTE) which comes standard on the N6760 and optional on the N6750. This enhancement to the N6750/60 DC Power Modules

#### Supplemental Characteristics

(Non-warranted characteristics determined by design that are useful in applying the product)

Programming Resolution						
Voltage	3.5 mV	4 mV	7 mV	10 mV	18 mV	28 mV
Current	7 mA	4 mA	3 mA	2 mA	1 mA	0.5 mA
Output Ripple and Noise (PARD)						
CC rms	8 mA	4 mA	2 mA	2 mA	2 mA	2 mA
Over-voltage Protection						
Accuracy (without relay option)	0.25% + 50 mV	0.25% + 50 mV	0.25% + 75 mV	0.25% + 100 mV	0.25% + 200 mV	0.25% + 250 mV
Response Time	50 μs from occurence of 0V condition to start of output shutdown					
Maximum Up-programming and Down-programming Time with full resistive load: (time from 10% to 90% of total voltage excursion)						
Voltage setting from 0 V to full scale and full scale to 0 V	20 ms	20 ms	20 ms	20 ms	20 ms	20 ms
Maximum Up-programming and Down-programming Settling Time with full resistive load: (time from start of voltage change until voltage settles within 0.1% of the full-scale voltage of its final value)						
Voltage setting from 0 V to full scale and full scale to 0 V	100 ms	100 ms	100 ms	100 ms	100 ms	100 ms

extends the capabilities to include features similar to a built-in arbitrary waveform generator and a built-in oscilloscope. Through the LIST mode of HSTE, you can download up to 512 setpoints of voltage and current. In LIST mode, you can program the output to execute a LIST of voltage and current setpoints. For each setpoint, a dwell time can be specified and the power supply will stay (i.e., dwell) at that setpoint for the programmed dwell time value.

The HSTE also provides an oscilloscope-like digitizer built into the power module to capture voltage and current measurements.

#### N6730/40 Family

The Agilent N6730 and N6740 families of DC power modules provide programmable voltage and current, measurement and protection features at a very economical price, making these modules suitable to power the DUT or to provide power for ATE system resources, such as fixture control. The N6730/40 families give you clean, reliable DC power without advanced features, plus gives you the added benefits of being apart of the N6700 MPS including small size (true 1U), mix-and-match with other N6700 DC Power Modules when you need performance along with basic DC outputs, connectivity via LAN, USB, and GPIB, and fast command processing time of less than 1 ms.

## Low-Profile Modular Power System

### 50-100 W GPIB (Continued)

#### Supplemental Characteristics for all model numbers

**DC Floating Voltage:** Output terminals can be floated up to  $\pm 240$  VDC from chassis ground

**Remote Sensing:** Output can maintain specifications with up to 1-volt drop per load lead

**Command Processing Time:** Average time required for the output voltage to begin to change following receipt of digital data is  $\leq 1$  ms.

#### High Speed Test Extensions:

##### List Mode:

- Number of steps = 1 to 512
- Dwell time = 1 to 262 s
- Maximum list repetitions = 256, or infinite

##### Digitizer:

- Measurement points = 1 to 4096
- Sample rate = 0.000025 Hz to 50 kHz

##### I/O Interface:

GPIB, LAN, USB standard

##### Software Driver:

- IVI-COM
- *VXIPlug&Play*

##### AC Input:

- Input Range: 85 – 265 VAC;  
50/60/400 Hz
- Power Consumption: 1000 VA typical;  
1100 VA maximum (with power  
factor correction)

#### Specifications

(at 0° to 55°C, and  
derated above 40°C)

##### Output Ratings

Voltage	5 V	8 V	20 V	35 V	60 V	100 V
Current	20 A	12.5 A	5 A	3 A	1.6 A	1 A
Power	100 W	100 W	100 W	100 W	100 W	100 W

##### Programming Accuracy<sup>2</sup> (at 23°C $\pm 5^\circ\text{C}$ )

Voltage	0.1% + 19 mV	0.1% + 19 mV	0.1% + 20 mV	0.1% + 35 mV	0.1% + 60 mV	0.1% + 100 mV
Current	0.15% + 20 mA	0.15% + 20 mA	0.15% + 20 mA	0.15% + 20 mA	0.15% + 20 mA	0.15% + 10 mA

##### Readback Accuracy (at 23°C $\pm 5^\circ\text{C}$ )

Voltage	0.1% + 20 mV	0.1% + 20 mV	0.1% + 20 mV	0.1% + 35 mV	0.1% + 60 mV	0.1% + 100 mV
Current	0.15% + 20 mA	0.15% + 10 mA	0.15% + 5 mA	0.15% + 4 mA	0.15% + 4 mA	0.15% + 2 mA

##### Output Ripple and Noise (PARD) (from 20 Hz – 20 MHz)

CV peak-to-peak	11 mV	12 mV	14 mV	15 mV	25 mV	30 mV
CV rms	2 mV	2 mV	3 mV	5 mV	9 mV	18 mV

##### Load Regulation<sup>1</sup>

Voltage	5 mV	6 mV	9 mV	11 mV	16 mV	30 mV
Current	2 mA	2 mA	2 mA	2 mA	2 mA	2 mA

##### Line Regulation

Voltage	1 mV	2 mV	2 mV	4 mV	6 mV	10 mV
Current	1 mA	1 mA	1 mA	1 mA	1 mA	1 mA

##### Transient Response Time

(time to recover to within the settling band following a load change from 50% to 100% and from 100% to 50% of full load.)

Voltage settling band	$\pm 100$ mV	$\pm 100$ mV	$\pm 300$ mV	$\pm 300$ mV	$\pm 500$ mV	$\pm 1000$ mV
Time	200 $\mu\text{s}$	200 $\mu\text{s}$	200 $\mu\text{s}$	200 $\mu\text{s}$	200 $\mu\text{s}$	200 $\mu\text{s}$

<sup>1</sup> With an output change from no load to full load, up to a maximum load-lead drop of 1 V per lead.

<sup>2</sup> Applies from minimum to maximum programming range. (see Supplemental Characteristics)

## Low-Profile Modular Power System

### 50-100 W GPIB (Continued)

#### Specifications

(at 0 ° to 55 °C, and derated above 40 °C)

N6741B

N6742B

N6743B

N6744B

N6745B

N6746B

**Regulatory Compliance:** European EMC directive 89/336/EEC for Class A products, Australian C-Tick mark, This ISM device complies with Canadian ICES-001. Cet appareil ISM est conforme à la norme NMB-001 du Canada. European Low Voltage Directive 73/23/EEC.

**Size (Mainframe):** 44.45 mm H x 432.5 mm W x 587.2 mm D (1.72 in x 17.03 in x 23.2 in)

**Weight (with 4 modules):**  
Net, 12.78 Kg (28 lbs)

**Warranty Period:** One year

#### Ordering Information

##### Options for N6700B Mainframe

**Opt 908** Rack Mount Kit

**Opt FLR** Filler Panel Kit

**Opt 0L1** Full documentation on CD-ROM, and printed standard documentation package

**Opt 0L2** Extra copy of standard printed documentation package

**Opt 0B0** Full documentation on CD-ROM only

**Opt 900** Power Cord, United Kingdom

**Opt 901** Power Cord, Australia

**Opt 902** Power Cord, Europe

**Opt 903** Power Cord, USA, Canada, 120 V

**Opt 904** Power Cord, USA, Canada, 240 V

**Opt 906** Power Cord, Switzerland

**Opt 912** Power Cord, Denmark

**Opt 917** Power Cord, South Africa, India

**Opt 918** Power Cord, Japan

**Opt 919** Power Cord, Israel

**Opt 920** Power Cord, Argentina

**Opt 922** Power Cord, China

**Opt 927** Power Cord, Thailand

#### Supplemental Characteristics

(Non-warranted characteristics determined by design and useful in applying the product)

Programming Resolution						
Voltage	3.5 mV	4 mV	7 mV	10 mV	18 mV	28 mV
Current	7 mA	4 mA	3 mA	2 mA	1 mA	0.5 mA
Output Ripple and Noise (PARD)						
CC rms	8 mA	4 mA	2 mA	2 mA	2 mA	2 mA
Over-voltage Protection						
Accuracy (without relay option)	0.25% + 50 mV	0.25% + 50 mV	0.25% + 75 mV	0.25% + 100 mV	0.25% + 200 mV	0.25% + 250 mV
Response Time	50 μs from occurrence of 0 V condition to start of output shutdown					
Maximum Up-programming and Down-programming Time with full resistive load: (time from 10% to 90% of total voltage excursion)						
Voltage setting from 0 V to full scale and full scale to 0 V	20 ms	20 ms	20 ms	20 ms	20 ms	20 ms
Maximum Up-programming and Down-programming Settling Time with full resistive load: (time from start of voltage change until voltage settles within 0.1% of the full-scale voltage of its final value)						
Voltage setting from 0 V to full scale and full scale to 0 V	100 ms	100 ms	100 ms	100 ms	100 ms	100 ms

#### Accessories for N6700B Mainframe

**N6709A** Rack Mount Kit (Opt 908)  
Required for rack mounting. Standard rack mount hardware will not work)

**N6708A** Filler Panel Kit (Opt FLR)  
Required when you have < 4 modules in an N6700B. Each filler panel kit contains 3 filler panels.

#### Options for Modules

**Opt 760** Open/Close and Polarity Reverse Relays  
(only available at time of order on models N6731B-N6736B, N6742B-N6746B)

**Opt 761** Output Disconnect Relays  
(only available at time of order)

**Opt UK6** Commercial calibration with test result data

**Opt 1A7** ISO 17025 Cal Certificate

**Opt 054** High-Speed Test Extension (N675x only) Comes standard on the N676xA, not available on N673x/4x





# Modular Power System

## 1200 W per mainframe GPIB

Modular system permits up to 8 outputs of 150 W per output in 4 U of rack space

Reconfigure fast with easily swappable modules

Fast, low-noise outputs

LIST mode and advance triggering system

Optional isolation and polarity reversal relays

Built-in measurements and advanced programmable features

Protection features to ensure DUT safety

**66000A (mainframe)**  
**66001A (keyboard)**

### Specifications

(at 0° to 55° C unless  
otherwise specified)

**66101A 66102A 66103A 66104A 66105A 66106A**

### 66000 Modular Power System

The Agilent 66000 modular power system simplifies test-system assembly, cabling, programming, debugging and operation. It is ideal for ATE and production test environments, where it can supply bias power and stimulus to sub-assemblies and final products. The modular power system saves rack space, the 7-inch-high (4-EIA units) mainframe can accommodate up to eight DC power modules.

#### Key Features

- GPIB-programmable voltage and current
- Programmable over-voltage and over-current protection
- Self-test initiated at power-up or from GPIB command
- Electronic calibration over GPIB or from keyboard
- Over-temperature protection
- Discrete fault indicator/remote inhibit (DFI/RI)
- Five nonvolatile store-recall states per output
- User-definable power-on state

### Multiple Mainframes at One GPIB Address

The Agilent serial link feature will allow you to control up to 16 outputs at one GPIB address by connecting an auxiliary mainframe. The serial link cable comes standard with the

#### Output ratings at 40° C

Output voltage	0 to 8 V	0 to 20 V	0 to 35 V	0 to 60 V	0 to 120 V	0 to 200 V
Output current	0 to 16 A	0 to 7.5 A	0 to 4.5 A	0 to 2.5 A	0 to 1.25 A	0 to 0.75 A
Maximum power	128 W	150 W	150 W	150 W	150 W	150 W

#### Programming accuracy at 25° C ±5° C

Voltage	0.03% +	3 mV	8 mV	13 mV	27 mV	54 mV	90 mV
Current	0.03% +	6 mA	3 mA	2 mA	1.2 mA	0.6 mA	0.4 mA

#### Readback accuracy

(via GPIB or keyboard display at 25° C ±5° C)

Voltage	0.02%+	2 mV	5 mV	8 mV	16 mV	32 mV	54 mV
Current	0.02%+	6 mA	3 mA	2 mA	1 mA	0.6 mA	0.3 mA

#### Ripple and noise (20 Hz to 20 MHz)

Constant Voltage rms	2 mV	3 mV	5 mV	9 mV	18 mV	30 mV
peak-peak	5 mV	7 mV	10 mV	15 mV	25 mV	50 mV
Constant Current rms	8 mA	4 mA	2 mA	1 mA	1 mA	1 mA

#### Line regulation

Voltage	0.5 mV	0.5 mV	1 mV	2 mV	3 mV	5 mV
Current	0.75 mA	0.5 mA	0.3 mA	0.1 mA	50 µA	30 µA

#### Load regulation

Voltage	1 mV	1 mV	1 mV	2 mV	4 mV	7 mV
Current	0.5 mA	0.2 mA	0.2 mA	0.1 mA	50 µA	30 µA

#### Transient response time

Less than 1 ms for the output voltage to recover within 100 mV of its previous level following any step change in load current up to 10 percent of rated current

#### Supplemental Characteristics

(Non-warranted characteristics determined by design that are useful in applying the product)

#### Average resolution

Voltage	2.4 mV	5.9 mV	10.4 mV	18.0 mV	36.0 mV	60.0 mV
Current	4.6 mA	2.3 mA	1.4 mA	0.75 mA	0.39 mA	0.23 mA
Output voltage programming (OVP)	50 mV	120 mV	200 mV	375 mV	750 mV	1.25 mV
OVP accuracy	250 mV	500 mV	800 mV	1 V	1.5 V	2.5 V

## Modular Power System

### 1200 W per mainframe GPIB (Continued)

66000 MPS mainframe. For applications with a broader range of power requirements, one 66000 mainframe can be connected with up to eight of the 6640, 6650, 6670, 6680, 6690 or 6030 series of system power supplies. This solution provides power ranges from 150 watts to 5000 watts at one primary GPIB address.

#### Output Connections

System assembly is simplified thanks to a quick-disconnect connector assembly on each module. Once your wires are connected to the load, the connector design permits the modules to be removed from the front of the mainframe without disconnecting cabling or removing the mainframe from the rack. One connector assembly is shipped with each module.

#### Output Sequencing

Increase test throughput by using the output sequencing feature of the 66000 MPS. This powerful feature allows you to download up to 20 voltage, current, and dwell-time parameter sets per output. This sequence can be paced by the programmed dwell times. As an alternative, triggers can be used to step through the output list. The output sequences can be executed without controller intervention, thereby increasing overall test system throughput. More detailed information on the triggering and output sequencing capabilities can be obtained by ordering the 66000 Modular Power System Product Note (p/n 5091-2497E) described below.

#### Specifications

(at 0° to 55°C unless otherwise specified)

##### Output ratings at 40°C

Output voltage	5.7 V	12 V	15 V	37 V	40 V
Output current	20 A	12 A	10 A	4.5 A	3.6 A
Maximum power	114 W	144 W	150 W	167 W	144 W

##### Programming accuracy at 25°C ±5°C

Voltage	0.03% +	2.5 mV	5 mV	8 mV	13 mV	15 mV
Current	0.03% +	8 mA	6 mA	4 mA	2 mA	2 mA

##### Readback accuracy (via GPIB keyboard display at 25°C ±5°C)

Voltage	0.02% +	2 mV	3 mV	5 mV	8 mV	9.2 mV
Current	0.02% +	8 mA	6 mA	4 mA	2 mA	2 mA

##### Ripple and noise (20 Hz to 20 MHz)

Constant Voltage rms	2 mV	3 mV	3 mV	5.3 mV	6 mV
peak-peak	5 mV	7 mV	7 mV	10.6 mV	11.5 mV
Constant Current rms	10 mA	8 mA	6 mA	2 mA	2 mA

##### Line regulation

Voltage	0.5 mV	0.5 mV	0.5 mV	1 mV	1 mV
Current	0.5 mA	0.75 mA	0.5 mA	0.3 mA	0.3 mA

##### Load regulation

Voltage	1 mV	1 mV	1 mV	1 mV	1 mV
Current	1 mA	0.5 mA	0.3 mA	0.2 mA	0.2 mA

##### Transient response time

Less than 1 ms for the output voltage to recover within 100 mV of its previous level following any step change in load current up to 10 percent of rated current

#### Supplemental Characteristics

(Non-warranted characteristics determined by design that are useful in applying the product)

<b>Average resolution</b>					
Voltage	2 mV	3.6 mV	4.5 mV	11 mV	12 mV
Current	6 mA	4.6 mA	3.1 mA	1.4 mA	1.2 mA
OVP	45 mV	75 mV	90 mV	200 mV	230 mV
<b>OVP accuracy</b>	250 mV	375 mV	375 mV	850 mV	920 mV

#### Application Notes:

##### 66000 Modular Power System

##### Product Note

5988-2800EN

##### 10 Practical Tips You Need to Know About Your Power Products

5965-8239E

##### 10 Hints for Using Your Power Supply to Decrease Test Time

5968-6359E

##### Agilent DC Power Supplies for Base Station Testing

5988-2386EN

## Modular Power System

### 1200 W per mainframe GPIB (Continued)

#### Supplemental Characteristics for all model numbers

**DC Floating Voltage:** Output terminals can be floated up to  $\pm 240$  Vdc from chassis ground

**Remote Sensing:** Up to half the rated output voltage can be dropped across each load lead. Add 2 mV to the voltage load regulation specification for each 1-V change in the negative output lead caused by a load current change.

**Command Processing Time:** The average time for the output voltage to change after getting an GPIB command is 20 ms

**Output Programming Response Time (with full resistive load):** The rise and fall time (10% to 90% and 90% to 10%) of the output voltage is less than 20 ms. The output voltage change settles within 0.1% of the final value in less than 120 ms.

**Down Programming:** An active down-programmer sinks approximately 10% of the rated output current

**Calibration Interval:** One year

#### AC Input of System Mainframe

**Voltage** 100 Vac 120 Vac 200 Vac 220 Vac 230 Vac 240 Vac

**Max. Current** 29 A 25 A 16 A 16 A 15 A 15 A

**Input Power of System Mainframe:** 3200 VA (max.), 1800 W (max.), 1600 W (typ.)

**GPIB Capabilities:** SH1, AH1, TE6, LE4, SR1, RL1, PP0, DC1, DT1, E1, and C0, and a command set compatible with IEEE-488.2 and SCPI

**Software Driver:**  
VXIPlug&Play

**Regulatory Compliance:** Listed to UL 1244; certified to CSA 22.2 No. 231; conforms to IEC 61010-1.

**Weight:** Net, 66000A, 15 kg (33 lb); 66001A, 1.05 kg (2.3 lb); 66101-66106A, 2.8 kg (6 lb). Shipping, 66000A, 19 kg (42 lb); 66001A, 1.34 kg (2.95 lb); 66101-66106A, 4.1 kg (9 lb).

**Size:** 66000A: 425.7 mm W x 192 mm H x 677.93 mm D (16.76 in x 7.28 in x 26.69 in), including feet and rear connectors

**Warranty Period:** One year

#### Specifications

(at 0° to 55° C unless otherwise specified)

#### 66103A-J09

Special Order Option

#### 66103A-J12

Special Order Option

#### 66104A-J09

Special Order Option

#### 66105A-J01

Special Order Option

#### Output ratings at 40° C

Output voltage	28.5 V	24 V	55 V	35 V
Output current	5.5 A	6 A	3 A	1.25 A
Maximum power	157 W	144 W	165 W	44 W

#### Programming accuracy at 25° C $\pm 5^{\circ}$ C

Voltage	0.03% +	13 mV	13 mV	25 mV	15 mV
Current	0.03% +	3 mA	3 mA	1.5 mA	0.6 mA

#### Readback accuracy (via GPIB or keyboard display at 25° C $\pm 5^{\circ}$ C)

Voltage	0.02% +	8 mV	8 mV	15 mV	9 mV
Current	0.02% +	3 mA	3 mA	1.2 mA	0.6 mA

#### Ripple and noise (20 Hz to 20 MHz)

Constant Voltage rms	5 mV	5 mV	9 mV	6 mV
peak-peak	10 mV	10 mV	15 mV	11.5 mV
Constant Current rms	4 mA	4 mA	1.2 mA	1 mA

#### Line regulation

Voltage	1 mV	1 mV	2 mV	1 mV
Current	0.3 mA	0.3 mA	0.1 mA	50 $\mu$ A

#### Load regulation

Voltage	1 mV	1 mV	2 mV	1 mV
Current	0.2 mA	0.2 mA	0.1 mA	50 $\mu$ A

#### Transient response time

Less than 1 ms for the output voltage to recover within 100 mV of its previous level following any step change in load current up to 10 percent of rated current

#### Supplemental Characteristics

(Non-warranted characteristics determined by design that are useful in applying the product)

<b>Average resolution</b>				
Voltage	10.4 mV	8 mV	16.5 mV	2 mV
Current	2 mA	2 mA	0.9 mA	1.2 mA
OVP	200 mV	150 mV	350 mV	230 mV
<b>OVP accuracy</b>	800 mV	600 mV	950 mV	920 mV

## Modular Power System 1200 W per mainframe GPIB (Continued)

### Ordering Information

**66000A** MPS Mainframe

\* **Opt 908** Rack-mount Kit (p/n 5063-9215)

\* **Opt 909** Rack-mount Kit with Handles (p/n 5063-9222)

**Opt 0L1** Full documentation on CD-ROM, and printed standard documentation package

**Opt 0L2** Extra copy of standard printed documentation package

**Opt 0B0** Full documentation on CD-ROM only

**Opt 0B3** Service Manual

\* **Note:** Options 908 and 909 require cabinet rails (E3663AC) or a slide kit (p/n 1494-0059) to support the loaded mainframe's weight.

**A line cord option must be specified, see the AC line voltage and cord section.**

**66001A** MPS Keyboard includes 2m (6 ft) cables

**66002A** Rack kit for 66001A keyboard

### Module Options

**Opt 760** Open/Close and Polarity Reversal Relays

**Opt J17** External Imon

**Opt 0L1** Full documentation on CD-ROM, and printed standard documentation package

**Opt 0L2** Extra copy of standard printed documentation package

**Opt 0B0** Full documentation on CD-ROM only

**Opt 0B3** Service Manual

### Accessories

**p/n 5060-3351** Field-Installable Relay Kit

**p/n 5060-3386** Standard Connector Assembly

**p/n 5060-3387** Standard Connector Assembly with installed relays (Option 760)

**p/n 66000-90001** Mainframe Installation Guide

**p/n 5959-3360** DC Power Module User's Guide

**p/n 5959-3362** DC Power Module Programming Guide

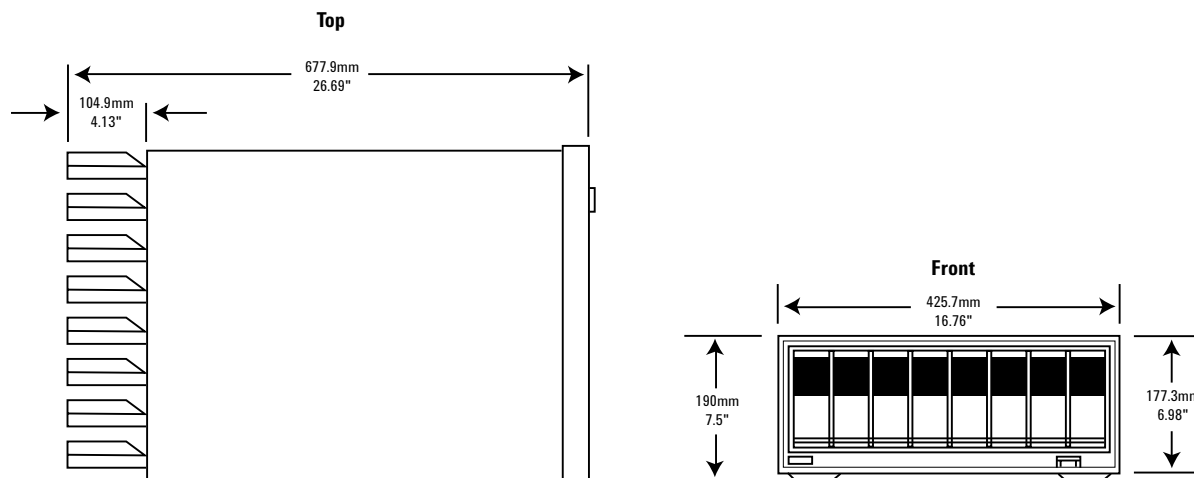
**p/n 66000-90003** Mainframe Service Manual

**p/n 5959-3364** DC Power Module Service Manual

**p/n 1252-1488** 4-Pin FLT/Inhibit Connector

**E3663AC** Support rails for Agilent rack cabinets

**Agilent Models: 66000A**



# Application Specific DC Power Supplies...

tailored solutions  
for specific needs

Some applications require specialized DC power supplies. This section contains DC power supplies that provide the solutions needed to solve some very specific application problems.

## Mobile Communication DC Sources

Battery life is a critical parameter for battery powered digital mobile communications devices such as cell phones, WLAN and Bluetooth™ enabled appliances. The pulsed characteristics of battery drain create unique powering and measuring requirements. With fast transient response, to react to pulsed current draw, and a flexible and fast measurement system, these DC sources are optimized for the needs of digital mobile communications devices.

## Solar Array Simulators

Solar panels consisting of multiple solar arrays provide power to satellites. They have unique V-I characteristics. Since the output power of a solar array varies with environmental conditions (i.e. temperature, darkness, light intensity), a specialized power supply must be used for accurate simulation.

## Component Test DC Source

Mixed signal IC testing requires speed, accuracy, and multiple DC outputs. This quad output DC source provides cost effective and compact biasing and measurement for semiconductor test systems.



66319B/D, 66321B/D

## Mobile Communications DC Sources

### 40-100 W

Ideal for testing wireless and battery powered devices

Several times improvement in measurement throughput over general purpose DC sources

Superior output transient performance with short or long load leads (up to 6 meters)

Dynamic measurement system for accurate battery current drain measurement

Easy-to-use Graphical User Interface and analysis tools for bench top use

#### Overcome Battery Powered Device Testing Challenges

Digital communications devices and digital battery powered devices present a unique testing challenge: they draw rapid pulses of current. By offering superior transient performance, unmatched in the marketplace, the Agilent Mobile Communications DC Sources dramatically reduce the transient voltage drop due to pulse loading characteristics of digital communications devices. The Agilent Mobile Communications DC Sources enable you to maximize test throughput by minimizing test interruption due to false trigger of device low voltage shutdown.

#### Dynamic Measurement Capabilities

The Agilent Mobile Communications DC Sources offer a built-in advanced measurement system to accurately measure battery current drains when the device operates in different modes (such as talk mode, active mode, standby mode, and off/sleep mode). Measurements made during these modes are critical for ensuring that your devices are operating properly and that you are getting the most out of the battery.

#### Simulate both Main Battery and Charger

Single output models are recommended when you need to provide power as a replacement to your

Specifications (at 0° to 55° C unless otherwise specified)	66309B/D	66311B/D	66319B/D	66321B/D	66332A	66332A-J01 Special Order Option
<b>Number of outputs</b>	2	1	2	1	1	1
<b> GPIB</b>	Yes	Yes	Yes	Yes	Yes	Yes
<b>Output ratings</b>						
Voltage	0 to 15 V	0 to 15 V	0 to 15 V	0 to 15 V	0 to 20 V	0 to 30 V
Current	0 to 3 A	0 to 3 A	0 to 3 A	0 to 3 A	0 to 5 A	0 to 3.3 A
Peak current for up to 7 ms	5 A	5 A	5 A	5 A	5 A	3.3 A
<b>Programming accuracy at 25°C ±5°C (% of setting plus fixed)</b>						
Voltage	0.05%+	10 mV	10 mV	10 mV	10 mV	15 mV
+Current	0.05%+	1.33 mA	1.33 mA	1.33 mA	2 mA	2 mA
<b>Ripple and Noise (20 Hz to 20 MHz)</b>						
Voltage rms	1 mV	1 mV	1 mV	1 mV	0.3 mV	0.5 mV
peak-to-peak	6 mV	6 mV	6 mV	6 mV	3 mV	5 mV
Current rms	2 mA	2 mA	2 mA	2 mA	2 mA	2 mA
<b>DC measurement accuracy</b>						
Voltage	0.03%+	5 mV	5 mV	5 mV	3 mV	5 mV
+20 mA to + rated current	0.2%+	0.5 mA <sup>2</sup>	0.5 mA <sup>2</sup>	—	0.5 mA	0.5 mA
-20 mA to - rated current	0.2%+	1.1 mA	1.1 mA	—	1.1 mA	1.1 mA
-3 A to + 5 A	0.2%	—	—	0.5 mA <sup>2</sup>	—	—
-1 A to + 1 A	0.1%	—	—	0.2 mA	—	—
-20 mA to + 20 mA range	0.1%+	2.5 µA	2.5 µA	2.5 µA	2.5 µA	2.5 µA
<b>Dynamic measurement system</b>						
Buffer size	4096 points	4096 points	4096 points	4096 points	4096 points	4096 points
Sampling interval	15 µs - 31,200 s	15 µs - 31,200 s	15 µs - 31,200 s	15 µs - 31,200 s	15 µs - 31,200 s	15 µs - 31,200 s
<b>Transient response time</b>	<35 µs <sup>3</sup>	<35 µs <sup>3</sup>	<20 µs <sup>3</sup>	<20 µs	<100 µs <sup>4</sup>	<100 µs <sup>4</sup>
<b>Transient voltage dip</b> (typical with up to 15 feet 22 AWG wiring)	70 mV	70 mV	40 mV	40 mV	500 mV	650 mV
<b>Programmable output resistance</b>						
Range	—	—	-40 mΩ to +1 Ω	-40 mΩ to +1 Ω	—	—
Programming accuracy	—	—	0.5% + 2 mΩ	0.5% + 2 mΩ	—	—
Resolution	—	—	1 mΩ	1 mΩ	—	—

More detailed specifications at [www.agilent.com/find/66300](http://www.agilent.com/find/66300)

## Mobile Communications DC Sources 40-100 W (Continued)

device's main battery during testing. Dual output models are recommended when you need to provide power as a replacement to your device's main battery and when you need to simulate the battery charger power; Use one output to supply current to the battery charger input port and the second output to connect in place of the main battery (which sinks current to simulate the main battery being charged).

### Performs Like a Battery

With their battery emulation features, the Agilent 66319B/D and 66321B/D allow you to test your devices under the same power conditions that exist in actual use. Emulating the battery is key when characterizing battery operating life and detecting early product failures. These DC sources simulate the effects of internal resistance of the battery, enabling them to emulate the operation of various battery types or batteries in different charge states. Plus, these DC sources can simulate negative resistance so that you can compensate for voltage drop due to wiring in a fixture.

### Feature Summary

Agilent has designed in the capability and flexibility that is required for accurately testing today's communications devices as well as your next generation designs for cell phones (formats include: 3G, cdma2000, WCDMA, CDMA, TDMA, GSM, PCS, DECT, TETRA, PHS, NADC), PDAs, *Bluetooth*™ enabled devices, and Wireless LAN access devices.

### Specifications

(at 0° to 55°C unless otherwise specified)

**Voltmeter input** (66309D, 66319D, 66311D and 66321D only)

Input range

-25 to  
+25 Vdc

-25 to  
+25 Vdc

-25 to  
+25 Vdc

-25 to  
+25 Vdc

—  
—

—  
—

DC readback accuracy  
(at 25°C ±5°C)

0.04% +  
5 mV

0.04% +  
5 mV

0.04% +  
5 mV

0.04% +  
5 mV

—  
—

—  
—

AC + DC readback accuracy  
(at 25°C ±5°C) with DC plus  
a sinewave input > 25 mV rms

1% +  
5 mV  
(60 Hz to  
10 kHz)

1% +  
5 mV  
(60 Hz to  
10 kHz)

1% +  
5 mV  
(60 Hz to  
10 kHz)

1% +  
5 mV  
(60 Hz to  
10 kHz)

—  
—  
—  
—

—  
—  
—  
—

**Auxiliary output**  
(66309B/D and 66319B/D)

Output ratings

Voltage

0 to 12V

—

0 to 12V

—

—

—

Current

0 to 1.5 A

—

0 to 1.5 A

—

—

—

Programming accuracy

Voltage

0.2% +  
40 mV

—

0.2% +  
40 mV

—

—

—

+Current

0.2% +  
4.5 mA

—

0.2% +  
4.5 mA

—

—

—

DC measurement accuracy

Voltage

0.2% +  
15 mV

—

0.2% +  
15 mV

—

—

—

+Current

0.2% +  
3 mA

—

0.2% +  
3 mA

—

—

—

Ripple and Noise (20 Hz to 20 MHz)

Voltage

rms

1 mV

—

1 mV

—

—

—

peak-to-peak

6 mV

—

6 mV

—

—

—

Current

rms

2 mA

—

2 mA

—

—

—

Notes:

<sup>1</sup> 66332A also has RS-232 interface.

<sup>2</sup> Applies with current detector set to DC.

<sup>3</sup> Time for the output voltage to recover to within 20 mV of final value after 0.1 to 1.5 A load change in high capacitance compensation range.

<sup>4</sup> Time for the output voltage to recover to within 20 mV or 0.1% of the voltage rating of the unit following a change in load current of up to 50% of the output current rating.

### Supplemental Characteristics

(Non-warranted characteristics determined by design and useful in applying the product)

#### DC Floating Voltage

Output terminals can be floated up to +/- 50 Vdc maximum from chassis ground (+/- 240 Vdc for 66332A)

#### Remote Sensing Voltage Drop

For 66332A: Up to 2 V can be dropped in each load lead. Add 2 mV to the load regulation specification for each 1 V drop in the positive output lead. For 66309B/D, 66311B/D: Up to 4 V can be dropped in each load lead. Add 2 mV to the load regulation specification for each 1 V drop in the positive output lead. For 66319B/D main output, 66321B/D main

output: Up to 3 V total can be dropped in both load leads. For 66319B/D auxiliary output, 66321B/D auxiliary output: Up to 4 V total can be dropped in both load leads.

#### Command Processing Time

Average time required for the output voltage to begin to change following receipt of GPIB data is 4 ms (with display disabled).

## Mobile Communications DC Sources 40-100 W (Continued)

### All models offer:

- Fast output response technology
- Programmable output response compensation
- Advanced DSP-based dynamic measurements
- Current sinking for testing and calibrating charger circuitry
- Extensive protection features (including broken sense lead detection)
- GPIB Interface, SCPI (Standard Commands for Programmable Instruments), *VXIplug&play* drivers

### In addition, the 66319B/D and 66321B/D high performance models offer:

- Output resistance programming (positive and negative)
- Superior output stability with up to 6 meters of load leads
- Excellent transient voltage drop (typically < 30 mV)
- Three current measurement ranges
- NEW! Additional advanced battery drain measurements (CCDF, long term battery drain)

The new and improved 66319B/D and 66321B/D high performance models are recommended for new automated test system platforms and for R&D applications. The 66309B/D and the 66311B/D are available for those customers who need to replicate existing test platforms and who do not want to re-engineer existing automated test system designs.

### Supplemental Characteristics

(Non-warranted characteristics determined by design and useful in applying the product)

(Continued)

#### Output Programming Response Time

For 66332A: The rise and fall time (10/90% and 90/10%) of the output voltage is < 2 ms (400  $\mu$ s in fast mode). The output voltage change settles within 1 LSB (0.025% x full scale voltage) of final value in < 6 ms (2 ms in fast mode). For 66311B/D, 66321B/D, 66309B/D output 1, 66319B/D output 1: The rise and fall time (10/90% and 90/10%) of the output voltage is < 200  $\mu$ s.

#### Measurement Time

Average time to process query, calculate measurement parameter and return data is 50 ms (includes the default time of 30 ms for acquiring data and 20 ms data processing overhead).

#### GPIB Interface Capabilities

IEEE-488.2, SCPI command set, 6630A series programming capability (not supported in 66309B/D, 66319B/D, 66321B/D)

#### Software Driver:

- *VXIPlug&Play*
- IntuiLink Connectivity Software

#### Input power

(at worst case conditions: full load, 100 Vac mains)  
For 66311B/D, 66321B/D: 1.7 A, 125 W.  
For 66309B/D, 66319B/D: 2 A, 170 W.  
For 66332A: 3.5 A, 250 W.

#### Regulatory Compliance

Complies with EMC directive 89/336/EEC (ISM 1B).

#### Warranty Period

One year

#### Size

For 66309B/D, 66311B/D, 66319B/D, 66321B/D: 212.8 mm W x 88.1 mm H x 435 mm D (8.4 in x 3.5 in x 17.13 in).  
For 66332A: 425.5 mm W x 88.1 mm H x 364.4 mm D (16.8 in x 3.5 in x 14.3 in).

#### Weight

For 66309B/D, 66311B/D, 66319B/D, 66321B/D: 9.07 kg (20 lb) net, 11.1 kg (24.5 lb) shipping. For 66332A: 12.7 kg (28 lb) net, 15.0 kg (33 lb) shipping.

### Application Notes:

#### Mobile Communications Device Testing

(AN 1310)  
5968-2424EN

#### Evaluating Battery Run-down Performance Using the Agilent 66319D or 66321D with Option #053 14565A

Device Characterization Software  
(AN 1427)  
5988-8157EN

#### Using Battery Drain Analysis to Improve Mobile-Device Operating Time

5988-7772EN

#### Current Drain Analysis Enhances WLAN Network Card Design and Test

(AN 1468)  
5989-0565EN



## Mobile Communications DC Sources 40-100 W (Continued)

### Ordering Information

**Opt 100** 87 to 106 Vac, 47 to 63 Hz  
**Opt 120** 104 to 127 Vac, 47 to 63 Hz  
**Opt 220** 191 to 233 Vac, 47 to 63 Hz  
**Opt 230** 207 to 253 Vac, 47 to 63 Hz  
**Opt 004** Make "Hi Compensation Mode" as default setting  
**Opt 020** Front-panel Binding Posts (66332A only)  
**Opt UJ0** No front panel binding posts (66332A only)  
**Opt 053** Add 14565A Device Characterization Software with Battery Drain Analysis (66319B/D, 66321B/D)  
**Opt 521** Solid State Relays (66309B/D, 66319B/D)  
**Opt AYK** No Solid State Relays (66309B/D, 66319B/D)  
**Opt 760** Isolation and Reversal Relays (66332A only)  
**Opt 8ZJ** Delete feet  
**Opt 8ZL** Include feet

\* **Opt 1CM** Rack-mount kit 66309B/D, 66311B/D, 66319B/D, 66321B/D: p/n 5062-3972; 66332A: p/n 5062-1912  
 \* **Opt 1CP** Rack-mount Kit with Handles, p/n 5062-3975 (66332A only)  
 \* **Opt AXS** Rack-mount Kit for side-by-side mounting, (N/A for 66332A) Locking Kit p/n 5061-9694; Flange Kit p/n 5062-3974  
**Opt 0L1** Full documentation on CD-ROM, and printed standard documentation package  
**Opt 0L2** Extra copy of standard printed documentation package  
**Opt 0B0** Full documentation on CD-ROM only  
**Opt 0B3** Service manual

\*Support rails required

### Accessories

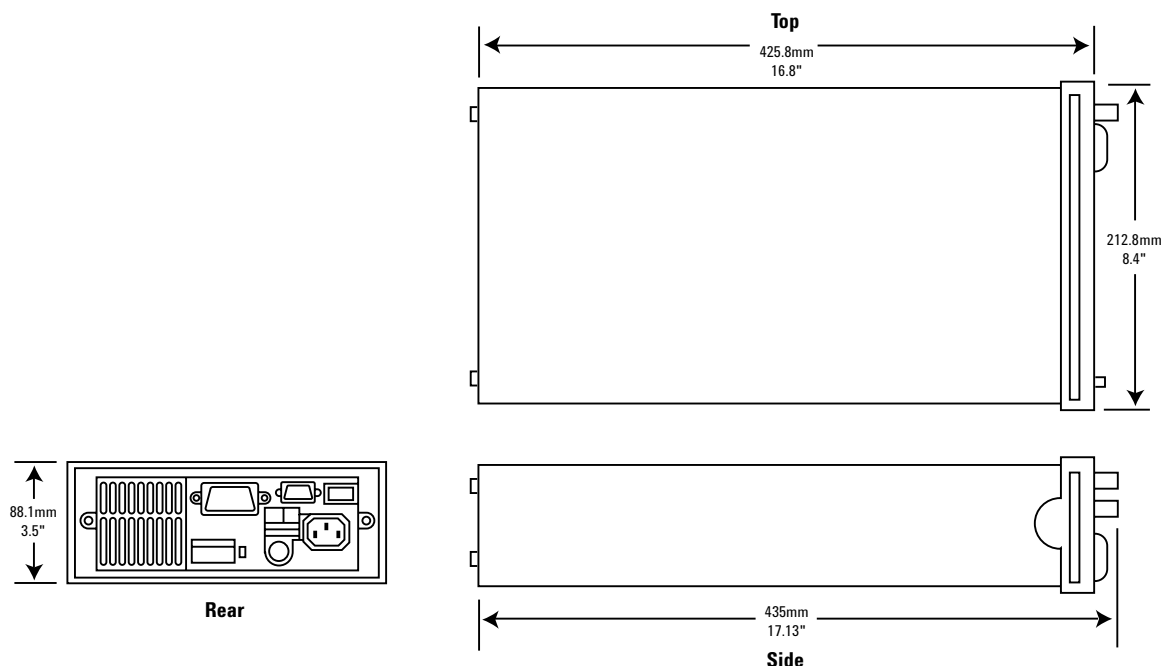
**p/n 1494-0060** Rack Slide Kit (66332A only)

**E3663AC** Support rails for Agilent rack cabinets

**14565A** Device Characterization Software with Battery Drain Analysis

*Note:* Battery Drain Analysis means Data Logging and CCDF measurements. These capabilities require models 66319B, 66319D, 66321B or 66321D with version A.03.00 firmware or higher and 14565A software version 3.01 or higher.

**Agilent Models: 66309B/D, 66311B/D, 66319B/D, 66321B/D**



More detailed specifications at [www.agilent.com/find/66300](http://www.agilent.com/find/66300)

# Mobile Communications DC Sources

## 40-100 W (Continued)

Agilent Models: 66332A

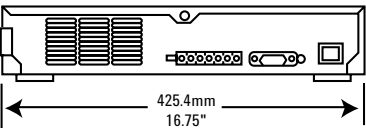
Terminal Strip Detail

Output 2 & 3

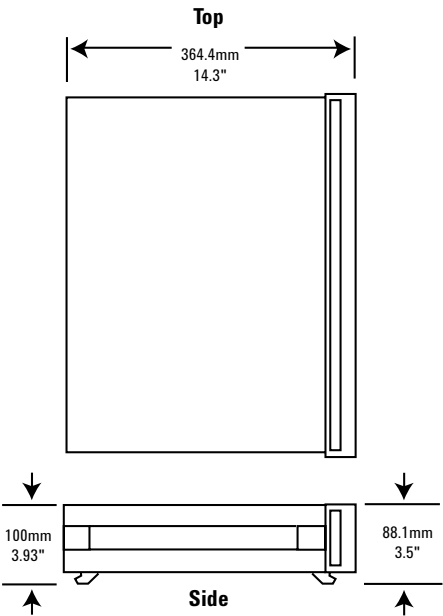
+S + - -S ⊥



Screw Size:  
M35 x 0.6



Rear



## Mobile Communications DC Sources 14565A Device Characterization Software



Ideal for testing wireless and battery powered devices

Converts Mobile Communications DC Source into a powerful bench top tool for R&D and Repair

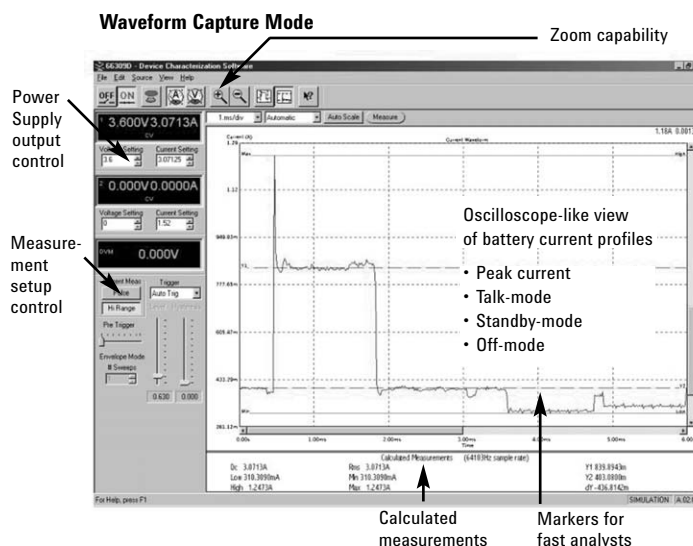
Easy-to-use Graphical User Interface and analysis tools

No programming required

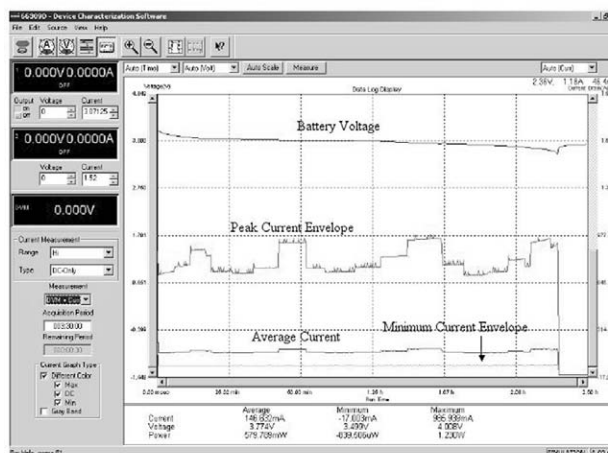
### Simplify test and analysis in R&D or on the repair bench

With the Agilent 14565A Device Characterization Software, testing, analyzing, and troubleshooting wireless and battery powered devices is made simple. The 14565A provides a graphical user interface that lets you easily control the Mobile Communications DC Sources. It gives you access to the Mobile Communications DC Source's high-powered measurement system and provides an oscilloscope-like view of the voltage or current waveforms of the device under test. The 14565A provides reference waveform save/recall, and provides oscilloscope-like measurement and analysis including voltage and current waveform parameter measurements, triggering, markers, zoom control, and more. By using the advanced capabilities built into the power supply, you can spend more time testing and analyzing instead of configuring and reconfiguring multiple pieces of test equipment, such as a current shunt, oscilloscope, current probe, DMM, and datalogger.

(Continued)



### Data Logging Mode



## Mobile Communications DC Sources Device Characterization Software (Continued)

When coupled with the 66319B/D or the 66321B/D, the 14565A also provides Battery Drain Analysis capabilities. More than just measuring battery run time, Battery Drain Analysis allows you to characterize current out of the battery and make tradeoffs in design that impact the current drain and battery life. This new version of the 14565A includes the measurement and data reduction tools needed to analyze and visualize the current being drained from your battery. By providing CCDF measurements and long-term battery drain data logging, the 14565A and 66319/21 provide a complete solution for analyzing current drain so that you can optimize your device designs to achieve maximum battery run time.

### Key features

#### For R&D

- Fast and easy test setup
- Digitize current waveforms
- Accurately log battery current drain measurements from 10 seconds to 1000 hours at 64,000 measurements per second
- Test designs simulating different battery conditions with programmable output resistance
- Zoom capability for analyzing waveform anomalies
- Adjust markers for fast measurements on digitized waveforms
- Easily document your test results
- Record test data to files for archive or analysis by other software packages

#### For Repair

- Compact design with multiple instrument functionality
- Fast and easy test setup
- Graphical user software, no programming required
- Dual DC outputs for replacing the main battery and the power adapter/charger power source
- Electronic load for testing the battery charger circuitry
- Programmable soft limits to protect against incorrect voltage settings

### Ordering Information

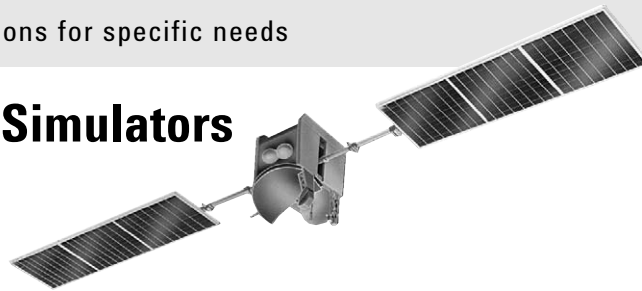
**14565A** Device Characterization Software with Battery Drain Analysis

*Note:* Battery Drain Analysis means Data Logging and CCDF measurements. These capabilities require models 66319B, 66319D, 66321B or 66321D with version A.03.00 firmware or higher and 14565A software version 3.01 or higher.



E4350B, E4351B

## Solar Array Simulators



Fast and accurate simulation of any type of solar array

Multiple simulation modes

Fast recovery time

Easy to simulate environmental conditions

The Agilent one-box Solar Array Simulator (SAS) is a DC power source that simulates the output characteristics of a solar array. The SAS is primarily a current source with very low output capacitance and is capable of simulating the I-V curve of different arrays under different conditions (i.e., temperature, age etc.). The I-V curve is programmable over the IEEE-488.2 bus and is conveniently generated within the SAS. The SAS provides three current operating modes:

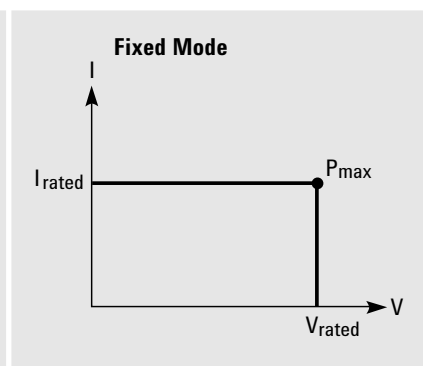
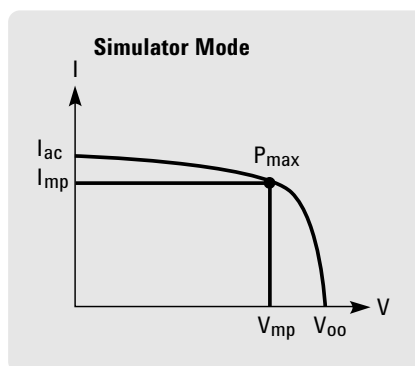
**1. Simulator Mode:** An internal algorithm is used to approximate a SAS I-V curve. Four input parameters: Voc (open circuit voltage), Isc (short circuit current), Imp and Vmp (current and voltage at the peak power point on the curve) are needed to establish a curve in this mode.

**2. Table Mode:** For a fast and accurate I-V simulation, the SAS provides a table mode. The I-V curve is set by a user-defined table of points. A table can have any length up to 4000 points (a point corresponds to a specific value of I and V). As many as 30 tables may be stored in each of the SAS built-in volatile and non-volatile memory.

### Specifications

(at 0° to 55°C unless otherwise specified)

	E4350B	E4351B	E4350B-J01 Special Order Option	E4350B-J02 Special Order Option
<b>Number of outputs</b>	1	1	1	1
<b> GPIB</b>	Yes	Yes	Yes	Yes
<b>Output ratings</b> (Simulator and Table Modes)				
Max. Power	480 W	480 W	480 W	480 W
Voc. Max.	65 V	130 V	54 V	86.6 V
Isc. Max.	8 A	4A	9.6 A	6 A
<b>Output ratings</b> (for mixed mode)				
Max Power	480 W	480 W	480 W	480 W
V rated	0-60 V	0-120 V	0-50 V	0-80 V
I rated	0-8 A	0-4 A	0-9.6 A	0-6 A
<b>Programming accuracy</b> at 25°C ±5°C				
Voltage (Fixed Mode)	0.075% + 10 mV	0.075% + 20 mV	0.075% + 8.5 mV	0.075% + 13.5 mV
Current (Simulator and Fixed Mode)	0.2% + 20 mA	0.2% + 10 mA	0.2% + 25 mA	0.2% + 15 mA
<b>Ripple and noise</b> from 20 Hz to 20 MHz				
Voltage rms	16 mV	24 mV	16 mV	21 mV
Voltage p-p	125 mV	195 mV	125 mV	175 mV
Current rms	4 mA	4 mA	4 mA	4 mA



## Solar Array Simulators (Continued)

Non-volatile memory can store a maximum of 3500 points. The tables (I-V curves) are easily stored and recalled with an IEEE-488.2 command. The table(s) stored in this memory will be retained when the power is turned off. Volatile memory greatly increases the flexibility by saving up to 30,000 points. Multiple tables are easily accessed with IEEE-488.2 command. These tables will be erased after power is removed.

In Table Mode, current and voltage offsets can be applied to the selected table to simulate a change in the operating conditions of the solar array.

**3. Fixed Mode:** This is the default mode when the unit is powered on. The unit has the rectangular I-V characteristics of a standard power supply, when an output capacitor is added in this mode.

### Application Notes:

**Sequential Shunt Regulation**  
(AN 1293)  
5965-7329E

**Modern Connectivity -  
Using USB and LAN I/O Converters**  
(AN 1475-1)  
5989-0123EN

### Specifications

(at 0° to 55°C unless  
otherwise specified)

### E4350B- J03

Special Order  
Option

### E4350B- J04

Special Order  
Option

### E4350B- J06

Special Order  
Option

Number of outputs	1	1	1
GPIO	Yes	Yes	Yes
Output ratings (Simulator and Table Modes)			
Max. Power	480 W	480 W	480 W
Voc. Max.	52 V	47 V	74 V
Isc. Max.	10 A	11 A	7 A
Output ratings (for mixed mode)			
Max Power	480 W	480 W	480 W
V rated	0 - 48 V	0 - 43.5 V	0 - 68 V
I rated	0.10 A	0 - 10 A	0 - 7 A
Programming accuracy at 25°C ±5°C			
Voltage (Fixed Mode)	0.075% + 8 mV	0.075% + 8 mV	0.075% + 11.5 mV
Current (Simulator and Fixed Mode)	0.2% + 27.5 mA	0.2% + 30.5 mA	0.2% + 17.5 mA
Ripple and noise			
from 20 Hz to 20 MHz			
Voltage rms	16 mV	16 mV	19 mV
Voltage p-p	125 mV	125 mV	150 mV
Current rms	5.5 mA	6.5 mA	4 mA

### Supplemental Characteristics for all model numbers

**Load Switching Recovery Time:** < 5 µs when switched from short circuit to variable load, to within 1.5 A of an operating point on the I-V curve.

**Remote Sensing:** Up to 2 V+ (Voc-Vmp). Add 3 mV to the voltage load regulation specification for each 1 volt change in the positive output lead due to load current change.

### Analog Programming of Output Current

**Input Signal:** 0 to -4.0 V

**Input Impedance:** 20 k Ohms nominal

**Shunt Regulation:** Switching frequency up to 50 kHz

**Series Regulation:** Switching frequency up to 50 kHz

**OVP and OCP:** Overvoltage and overcurrent protection triggers in ≤100 µs

**Capacitive Load:** In fixed mode, the maximum load capacitance (without causing instability) is 2000 µF. In simulator and table mode, it is unconditionally stable at all capacitive loads.

**Inductive Load:** The maximum load inductance (without causing instability) is 200 µH

**Software Driver:**  
VXIPlug&Play

**Regulatory Compliance:** Listed to UL3101, certified to CSA 22.2 No. 1010.1, complies with EN 61010-1.

**RFI Suppression:** Complies with CISPR-11, Group 1, Class A

**Size:** 425.5 mm W x 132.6 mm H x 497.8 mm D (16.75 in x 5.25 in x 19.6 in)

**Weight:** Net, 25 kg (54 lb); shipping, 28 kg (61 lb)

**Warranty:** One year

## Solar Array Simulators (Continued)

### Ordering Information

**Opt 100** 87 to 106 Vac, 47 to 63 Hz

**Opt 120** 104 to 127 Vac, 47 to 63 Hz

**Opt 220** 191 to 233 Vac, 47 to 63 Hz

**Opt 240** 209 to 250 Vac, 47 to 63 Hz

\* **Opt 908** Rackmount Kit, p/n 5062-3977

\* **Opt 909** Rackmount Kit with Handles, p/n 5063-9221

**Opt 0L1** Full documentation on CD-ROM, and printed standard documentation package

**Opt 0L2** Extra copy of standard printed documentation package

**Opt 0B0** Full documentation on CD-ROM only

**Opt 0B3** Service Manual

\* Support rails required

### Accessories

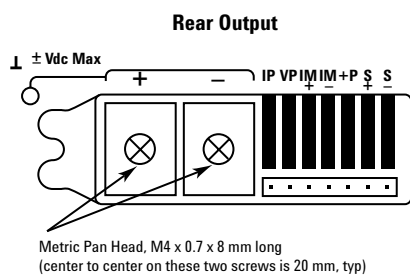
p/n **1252-3698** 7-pin Analog Plug

p/n **1252-1488** 4-pin Digital Plug

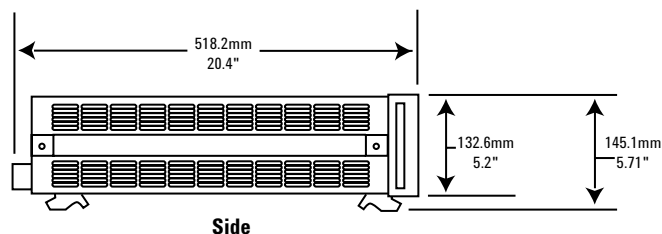
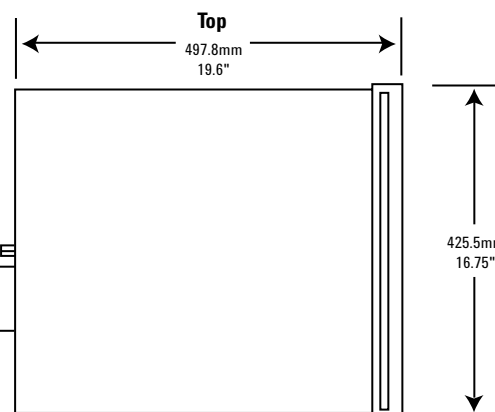
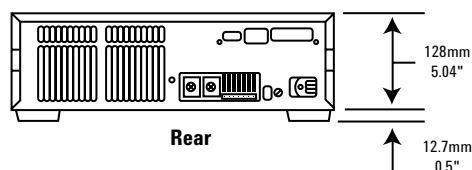
p/n **5080-2148** Serial Link Cable  
2 m (6.6 ft)

p/n **1494-0059** Accessory Slide Kit

### Agilent Models: E4350B, E4351B



Terminal Screw Size: 6-32 x 5/16in



More detailed specifications at [www.agilent.com/find/E4350](http://www.agilent.com/find/E4350)



## Component Test DC Source N3280A

Save valuable rack space with 4 outputs in a one-half rack box  
 Increase system throughput with fast command processing time  
 Accurately measure low level (nA) currents with its 16-bit measurement system  
 Synchronize measurements to an external event using the trigger system

The new N3280A DC source offers semiconductor ATE manufacturers a reduction in test time, integration time and rack space. It is a fast, low-power four-output ( $\pm 10$  V/ $\pm 0.5$  A) bipolar power supply optimized for testing RF and mixed signal semiconductors.

Valuable rack space is saved, by providing four bipolar outputs that eliminates the need for four separate sources and an external polarity reversal relay.

The N3280A helps maximize test system throughput with at least 5 times faster performance than many previous Agilent DC source. It provides reduced command processing time both for setting output levels and for acquiring measurements. Plus, any combination of outputs can be grouped in one programming command, further reducing test time.

Device current consumption can easily be measured and characterized with the digitizing measurement system. Each output has its own 16-bit precision voltmeter and ammeter. Additionally, three current

### Specifications

Applies to each of the four identical outputs (at  $25^\circ \pm 5^\circ \text{C}$ )

	Voltage Priority Mode	Current Priority Mode
<b>Number of Outputs</b>	4	
<b>GPIO</b>	Yes	Yes
<b>Output ratings<sup>1</sup></b>		
Voltage	-10.25 V to +10.25 V	-8 V to +8 V (full load) -11.25 V to +11.25 V (no load)
Current	-0.5125 A to +0.5125 A	-0.5125 mA to +0.5125 mA
<b>Programming accuracy at <math>25^\circ \text{C} \pm 5^\circ \text{C}</math></b>		
Voltage	0.1% $\pm 2$ mV	N/A
+Current	0.1% $\pm 50$ $\mu\text{A}$	N/A
-Current limit	0.1% $\pm 50$ $\mu\text{A}$	N/A
Current	N/A	0.1% $\pm 1$ $\mu\text{A}$
<b>Measurement Accuracy<sup>2</sup></b>		
Voltage	0.1% $\pm 2$ mV	0.1% $\pm 2$ mV
0.5 A current range	0.1% $\pm 200$ $\mu\text{A}$	0.1% $\pm 200$ nA
15 mA current range	0.1% $\pm 5$ $\mu\text{A}$	0.1% $\pm 200$ nA
0.5 mA current range	0.1% $\pm 200$ nA	0.1% $\pm 200$ nA
<b>Ripple and noise from 20 Hz to 20 MHz</b>		
Voltage rms	0.380 mV	N/A
Peak-to-peak	4 mV	N/A
$\pm$ Current limit rms	40 $\mu\text{A}$	N/A
Current rms	N/A	1.5 $\mu\text{A}$
<b>Load regulation (A change from no load to full load or full load to no load by varying a resistive load)</b>		
Voltage	$\pm 400$ $\mu\text{V}$	N/A
+Current limit	$\pm 30$ $\mu\text{A}$	N/A
-Current limit	$\pm 30$ $\mu\text{A}$	N/A
Current	N/A	$\pm 25$ nA

#### Notes:

<sup>1</sup> Full current at  $40^\circ \text{C}$ . Linearly derated to 50% of full current at  $55^\circ \text{C}$ .

<sup>2</sup> Measurement default is 5 measurement samples 30.4 microseconds apart. 0.5 mA range measured with the number of samples equivalent to one power line cycle.

More detailed specifications at [www.agilent.com/find/N3280](http://www.agilent.com/find/N3280)



## Component Test DC Source N3280A (Continued)

measurement ranges allows you to accurately measure low-level (nA) currents.

This quad-output source is easy to integrate into a test system. The hardware connections are intended for quick configuration and the software is built on the straightforward standard SCPI command set.

### Application Notes:

**10 Practical Tips You Need to Know About Your Power Products**  
5965-8239E

**10 Hints for Using Your Power Supply to Decrease Test Time**  
5968-6359E

**Understanding Linear Power Supply Operation**  
(AN1554)  
5989-2291EN

**Modern Connectivity - Using USB and LAN I/O Converters**  
(AN 1475-1)  
5989-0123EN

### Specifications

Applies to each of the four identical outputs (at  $25^{\circ} \pm 5^{\circ}\text{C}$ )

### Voltage Priority Mode

### Current Priority Mode

#### Line regulation

(A change in output voltage or current for any line change within ratings)

Voltage	$\pm 200\ \mu\text{V}$	N/A
+Current limit	$\pm 10\ \mu\text{A}$	N/A
-Current limit	$\pm 10\ \mu\text{A}$	N/A
Current	N/A	$\pm 10\ \text{nA}$

#### Output transient response

Voltage <sup>3</sup> :	BW = 10 kHz	60 $\mu\text{s}$	N/A
	BW = 20 kHz	45 $\mu\text{s}$	N/A
	BW = 30 kHz	35 $\mu\text{s}$	N/A
Current <sup>4</sup>		N/A	90 $\mu\text{s}$

### Supplemental Characteristics

(Non-warranted characteristics determined by design that are useful in applying this product)

#### Programming resolution

Voltage	312 $\mu\text{V}$	N/A
Current	N/A	16 nA

#### Measurement resolution

Voltage	312 $\mu\text{V}$	312 $\mu\text{V}$
Current:	0.5 mA current range	16 nA
	15 mA current range	16 nA
	0.5 A current range	16 nA

#### Programming output rise/fall time

Voltage (10% to 90% or 90% to 10%)	150 $\mu\text{sec}$	N/A
Current (-80% to +80%)	N/A	160 $\mu\text{s}$

#### Measurement speed<sup>5</sup>

(with 5 examples)

Voltage/current	1.3 ms (2.1 ms for all outputs simultaneously)	1.3 ms (2.1 ms for all outputs simultaneously)
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#### Notes:

<sup>3</sup> Time for output voltage to recover to within 40 mV of former value after a change from 0.25 A to 0.5 A or 0.5 A to 0.25 A

<sup>4</sup> Time for output current to recover to within 1 mA of former value after a change from -1 V to +1 V or +1 V to -1 V.

<sup>5</sup> Time from start of bus communication to final byte returned on bus. Assumes the default of 5 points 30.4  $\mu\text{s}$  apart.

## Component Test DC Source N3280A (Continued)

### Supplemental Characteristics for all model numbers

**DC Floating Voltage:** Output terminals can be floated up to  $\pm 50$  Vdc maximum from chassis ground and  $\pm 100$  Vdc from output to output.

**Remote Sensing:** Up to 1/2 the maximum output voltage may be dropped across each load lead. Add 1/2 mV to the load regulation for each 1 V change in the HI output lead.

**Command Processing Time:** The time to set an output parameter is 0.6 ms for a single output (0.7 ms for all outputs simultaneously). Time to query a setting is 1.0 ms (1.5 ms for all outputs simultaneously)

### Dynamic Measurement System

Buffer Size = 4096 points

Sampling rate increments = 30.4  $\mu$ s

### Input Power (full load):

Voltage	100 Vac	120 Vac	220 Vac	230 Vac
Current (max)	1.85 A	1.55 A	0.90 A	0.80 A
Power (max)	140 W	140 W	140 W	140 W

**Regulatory Compliance:** Complies with EMC directive 89/336/EEC (ISM group 1 Class A)

**Warranty Period:** One year

**Size:** 212.7 mm W x 88.9 mm H x 497.8 mm D (8.4 in x 3.5 in x 19.6 in)

**Weight:** 10 kg (22 lbs) net;  
11.8 kg (26 lbs) shipping

### Ordering Information

**Opt 100** 87 to 106 Vac, 47 to 63 Hz

**Opt 120** 104 to 127 Vac, 47 to 63 Hz

**Opt 220** 191 to 233 Vac, 47 to 63 Hz

**Opt 230** 207 to 253 Vac, 47 to 63 Hz

**Opt 0L1** Full documentation on CD-ROM, and printed standard documentation package

**Opt 0L2** Extra copy of standard printed documentation package

**Opt 0B0** Full documentation on CD-ROM only

**Opt 8ZL** Add feet – for bench use, p/n 5041-9167

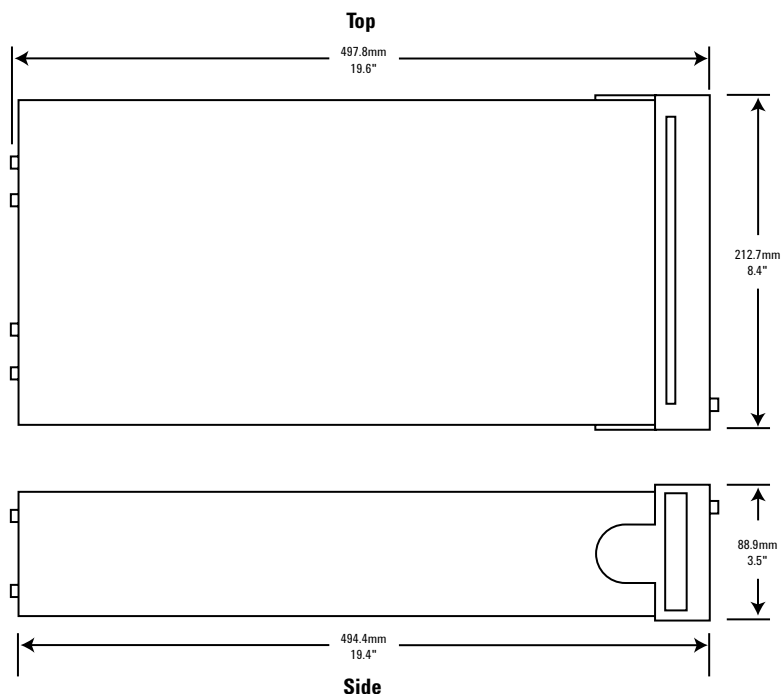
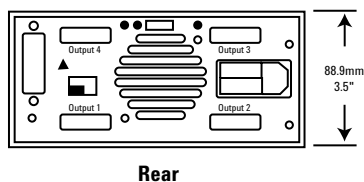
**Opt 1CM** Rackmount kit, p/n 5063-9240

**Opt AXS** Rackmount kit for side-by-side mounting, Lock-link kit p/n 5061-9694; Flange Kit p/n 5063-9212; Tie Bracket Kit p/n 5065-6947

### Accessories

**p/n N3280A-10001** Virtual Front Panel Software

### Agilent Models: N3280A



More detailed specifications at [www.agilent.com/find/N3280](http://www.agilent.com/find/N3280)

## DC Electronic Loads...

maximize throughput with  
real life loading conditions

Agilent DC Electronic  
Loads provide solutions  
for the problems of testing  
DC power sources.

### Multiple Input Electronic Loads

The Agilent N3300A series of DC electronic loads has been optimized for the needs of high volume manufacturing test. Test throughput is maximized with both faster speed and specialized programming and measurement capabilities. The accuracy is enhanced over previous Agilent electronic loads, to meet the needs of testing today's smaller power supplies.

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### Single Input Electronic Loads

The 6060B and 6063B are single input DC electronic loads. They are convenient for testing of one single output DC power supply. They provide a total solution, with built-in measurement functions. However, to maximize either speed or accuracy, the N3300A Series electronic loads are recommended.

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N3300A-N3307A

## Multiple-Input 150 W to 600 W



Standard DC  
connectors

Option UJ1 8 mm  
screw connectors

Decrease system development time  
Increase system reliability  
Increase system flexibility  
DC connection terminal for ATE applications

Lower cost of ownership  
Increase test system throughput  
Stable operation down to zero volts

### Increase Test Throughput

Today's high volume manufacturing requires optimization of test system throughput, to maximize production volume without increasing floor-space. The N3300A Series electronic loads can help you in a number of ways to achieve this goal.

**Reduced command processing time:**

Commands are processed more than 10 times faster than previous electronic loads.

**Automatically execute stored command sequences:** "Lists" of downloaded command sequences can execute independent of the computer, greatly reducing the electronic load command processing time and computer interaction time during product testing.

**Programmable delay allows for either simultaneous or sequential load changes:**

This is the most efficient way to conduct testing of multiple output DC power supplies, simulating real-life loading patterns, with a minimum of programming commands.

**Buffer measurement data:** Voltage, current, and power measurements can be buffered for later readback to the computer, reducing computer interaction.

**Control measurement speed vs. accuracy:**

Decrease the number of measurement samples to achieve greater measurement speed, or increase the number of samples to achieve higher measurement accuracy. You can optimize your measurements for each test.

**Control rising and falling slew rates separately:**

Reduce rate of loading change when necessary for DUT stability or to simulate real life conditions, but otherwise change load values at maximum rate.

### Increase System Flexibility... for both present and future requirements

Most power supply and battery charger test systems designed today need to test a variety of products and/or assemblies. In the future, additional products or assemblies may be needed. A flexible family of electronic loads makes present system design and future growth much easier.

**Test low voltage power supplies:** The N3300A series electronic loads operate with full stability down to zero volts. Many other electronic loads available today have been found to become unstable in the operating

region below one volt. When designing power supply test platforms, the trend towards lower voltage requirements should be taken into account. Refer to the specification and supplemental characteristic tables for details of lower voltage operating characteristics.

**Choose DC load connection method:**

Automatic test systems need consistency and reliability. Option UJ1 8 mm screw connectors provide a simple screw onto which your wires, terminated with insulated ring terminals, may be securely mounted. This optional connector is specifically designed for test systems. Wires may exit the plastic cover in any direction, and multiple wires may be placed on each screw terminal for easy parallel load connections. Up to AWG 4 wire may be used.

Applications which require repeated connections/disconnections are better suited to the standard connector. The standard connector accepts an unterminated wire, and may be hand-tightened. This connector is specifically designed for bench applications and short-term automated tests.

## Multiple-Input: 150 W to 600 W (Continued)

### Design a system to test a variety of

**products:** This series consists of 2 mainframes and 5 modules. The N3300A mainframe is full rack width. It has 6 slots. The N3301A mainframe is half rack width. It has 2 slots. Any assortment of the 5 different modules can be configured into these mainframes, up to the slot capacity. The N3302A (150 watts), N3303A (250 watts), N3307A (250 watts) and N3304A (300 watts) each require one slot. The N3305A (500 watts) and the N3306A (600 watts) each require 2 slots. The electronic load can be configured to supply exactly what you need now, and this modular design also allows for easy future reconfiguration.

### Test high current power supplies:

Electronic load modules can be operated in parallel to provide addition current sinking capability.

### Control the electronic load how you

**want to:** GPIB, RS232, and manual use of the front panel all provide complete control of these electronic loads. There are also analog programming and monitoring ports for those applications that utilize non-standard interfaces, require custom waveforms, or utilize process control signals. Custom waveforms can also be created by downloading a "List" of load parameters. In addition, there is a built-in transient generator, which operates in all modes.

### Quickly create powerful and consistent

**software:** All Agilent Technologies electronic loads use the SCPI (Standard Commands for Programmable Instruments) command set. This makes learning the commands easy, because they are the same format as all other SCPI instruments. The resulting code is virtually self-documenting, and therefore easier to troubleshoot and modify in the future. *Plug-n-Play* drivers are also available to help you to integrate the loads into your standard software packages.

### Make Measurements Easily and Accurately

The 16-bit voltage, current and power measurement system provides both accuracy and convenience. The alternative is using a dmm (digital multimeter) and MUX (multiplexer) along with a precision current shunt and a lot of extra wiring. Avoiding this complexity increases system reliability and makes the system easier to design and support. Current measurements in particular are more consistently accurate using the electronic load's internal system, because the wiring associated with an external precision current shunt may pick up noise.

### Measure with all load modules simulta-

**neously:** Testing multiple-output DC power supplies and DC-DC converters can be very time consuming if each output must be tested sequentially. If measurements are being made through a MUX using one

DMM, this is what will happen.

Using the built-in measurement capabilities of the N3300A electronic loads, all outputs can be measured simultaneously. Alternatively, multiple single output power sources can be tested simultaneously.

### Measure voltage and current

**simultaneously:** The N3300A measurement system has individual but linked current and voltage measurement systems. This means that voltage and current measurements are taken exactly simultaneously, which gives a true picture of the power supply under test's output at a particular moment in time. Some other electronic loads which feature internal measurement systems actually take current and voltage measurements sequentially, and therefore do not give as accurate a picture of momentary power.

### Observe transient behavior using wave-

**form digitization:** Transient response and other dynamic tests often require an oscilloscope. The N3300A has a flexible waveform digitizer with a 4096 data point buffer for voltage and a 4096 data point buffer for current. Under many circumstances, this internal digitizer will be adequate for power supply test needs. Current and voltage are digitized simultaneously, and the sampling rate and sample window are programmable. Some analysis functions are provided, including RMS, max and min.

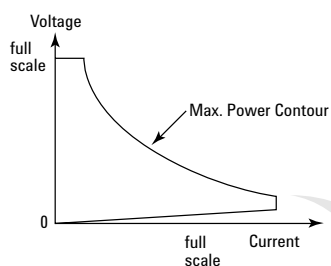
## Multiple-Input: 150 W to 600 W (Continued)

Table A-1 Specifications

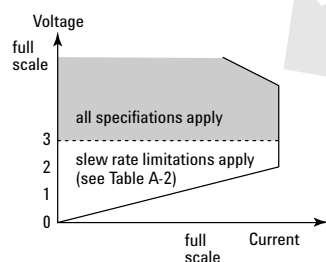
**Table A-1** lists the specifications for the different load models. Specifications indicate warranted performance in the 25°C ±5°C region of the operating temperature range. Specifications apply to normal and transient modes unless otherwise noted.

## Input Characteristic

## Operating Contour



## Derated Current Detail



## Notes

- Maximum continuous power available is derated linearly from 100% of maximum at 40°C, to 75% of maximum at 55°C.
- Specification is ± (% of reading + fixed offset). Measurement is 1000 samples. Specification may degrade when the unit is subject to an RF field of 3 V/meter, the unit is subject to line spikes of 500 V, or an 8 kV electrostatic discharge.
- DC current accuracy specifications apply 30 seconds after input current is applied.

## Input ratings

Current	0 - 30 A	0 - 10 A	0 - 60 A	0 - 60 A	0 - 120 A	0 - 30 A
Voltage	0 - 60 V	0 - 240 V	0 - 60 V	0 - 150 V	0 - 60 V	0 - 150 V
Maximum Power @ 40°C <sup>1</sup>	150 W	250 W	300 W	500 W	600 W	250 W
<b>Specified current @ low voltage operation</b>						
2.0 V	30 A	10 A	60 A	60 A	120 A	30 A
1.5 V	22.5 A	7.5 A	45 A	45 A	90 A	22.5 A
1.0 V	15 A	5 A	30 A	30 A	60 A	15 A
0.5 V	7.5 A	2.5 A	15 A	15 A	30 A	7.5 A
0 V	0 A	0 A	0 A	0 A	0 A	0 A

## Typical minimum operating voltage @ full scale current

Table A-1 states that maximum current is available down to 2 volts. Typically, however under normal operating conditions, the load can sink the maximum current down to the following voltages:

	1.2 V	1.2 V	1.2 V	1.4 V	1.4 V	1.4 V
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Constant current mode<sup>2</sup>

Low Range/High Range	3 A/30 A	1 A/10 A	6 A/60 A	6 A/60 A	12 A/120 A	3 A/30 A
Regulation	10 mA	8 mA	10 mA	10 mA	10 mA	10 mA
Low Range Accuracy 0.1% +	5 mA	4 mA	7.5 mA	7.5 mA	15 mA	7.5 mA
High Range Accuracy 0.1% +	10 mA	7.5 mA	15 mA	15 mA	37.5 mA	15 mA

Constant voltage mode<sup>2</sup>

Low Range/High Range	6 V/60 V	24 V/240 V	6 V/60 V	15 V/150 V	6 V/60 V	15 V/150 V
Regulation	5 mV	10 mV	10 mV	10 mV	20 mV	10 mV
Low Range Accuracy 0.1% +	3 mV	10 mV	3 mV	10 mV	3 mV	10 mV
High Range Accuracy 0.1% +	8 mV	40 mV	8 mV	20 mV	8 mV	20 mV

Constant resistance mode<sup>2</sup>

Range 1 (I > 10% of current rating)	0.067-4 Ω	0.2-48 Ω	0.033-2 Ω	0.033-5 Ω	0.017-1 Ω	0.067-10 Ω
Range 2 (I > 1% of current rating)	3.6-40 Ω	44-480 Ω	1.8-20 Ω	4.5-50 Ω	0.9-10 Ω	9-100 Ω
Range 3 (I > 0.1% of current rating)	36-400 Ω	440-4800 Ω	18-200 Ω	45-500 Ω	9-100 Ω	90-1000 Ω
Range 4 (I > 0.01% of current rating)	360-2000 Ω	4400-12000 Ω	180-2000 Ω	450-2500 Ω	90-1000 Ω	900-2500 Ω

## Transient generator

Frequency Range	0.25 Hz-10 kHz	0.25 Hz-10 kHz	0.25 Hz-10 kHz	0.25 Hz-10 kHz	0.25 Hz-10 kHz	0.25 Hz-10 kHz
Pulse Width	50 μs ±1% to 4 seconds ±1%	50 μs ±1% to 4 seconds ±1%	50 μs ±1% to 4 seconds ±1%	50 μs ±1% to 4 seconds ±1%	50 μs ±1% to 4 seconds ±1%	50 μs ±1% to 4 seconds ±1%

Current measurement<sup>2</sup>

Low Range/High Range	3 A/30 A	1 A/10 A	6 A/60 A	6 A/60 A	12 A/120 A	3 A/30 A
Low Range Accuracy <sup>3</sup> 0.05% +	3 mA	2.5 mA	5 mA	5 mA	10 mA	3 mA
High Range Accuracy <sup>3</sup> 0.05% +	6 mA	5 mA	10 mA	10 mA	20 mA	6 mA

Voltage measurement<sup>2</sup>

Low Range/High Range	6 V/60 V	24 V/240 V	6 V/60 V	15 V/150 V	6 V/60 V	15 V/150 V
Low Range Accuracy 0.05% +	3 mV	10 mV	3 mV	8 mV	3 mV	8 mV
High Range Accuracy 0.05% +	8 mV	20 mV	8 mV	16 mV	8 mV	16 mV

Power measurement<sup>2</sup>

Accuracy 0.1% +	0.5 W	1.2 W	0.5 W	1.5 W	1.2 W	0.5 W
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## Multiple-Input: 150 W to 600 W (Continued)

**Table A-2**  
**Supplemental Characteristics**

**Table A-2** lists the supplemental characteristics, which are not warranted but are descriptions of typical performance determined either by design or type testing.

**Notes**

1 Slew rate bands are the ranges of programmable slew rates available. When you program a slew rate value outside the indicated bands, the electronic load will automatically adjust the slew rate to fit within the band that is closest to the programmed value. It is not necessary to specify the band, only the slew rate itself.

Below 3 volts, the maximum bandwidth of the electronic load is reduced by a factor of ten to one. For example, in the current range for Model N3302A, the maximum slew rate is specified as 2.5 MA/s, below 3 volts the maximum slew rate would be 250 kA/s. Any slew rate programmed between 2.5 MA/s and 250 kA/s would produce a slew rate of 250 k/s. Slew rates programmed slower than 250 kA/s would still correctly reflect their programmed value. Note that if you are using transient mode to generate a high frequency pulse train, a reduced slew rate might cause the load to never reach the upper programmed value before beginning the transition to the lower programmed value. So even though the transient mode is still operational at lower voltages, a fast pulse train with large transitions may not be achievable.

		N3302A	N3303A	N3304A	N3305A	N3306A	N3307A
<b>Programming Resolution</b>							
Constant current mode		0.05 mA/ 0.5 mA	0.02 mA/ 0.2 mA	0.1 mA/ 1 mA	0.1 mA/ 1 mA	0.2 mA/ 2 mA	0.05 mA/ 0.5 mA
Constant voltage mode		0.1 mV/1 mV	0.4 mV/4 mV	0.1 mV/1 mV	0.25 mV/2.5 mV	0.1 mV/1 mV	0.25 mV/2.5 mV
Constant resistance mode		0.07/0.7/ 7/70 mΩ	0.82/8.2/ 82 mΩ	0.035/0.35/ 3.5/35 mΩ	0.085/0.85/ 8.5/85 mΩ	0.0175/0.175/ 1.75/17.5 mΩ	0.17/1.7/ 17/170 mΩ
<b>Readback resolution</b>							
Current		0.05 mA/ 0.5 mA	0.02 mA/ 0.2 mA	0.1 mA/ 1 mA	0.1 mA/ 1 mA	0.2 mA/ 2 mA	0.05 mA/ 0.5 mA
Voltage		0.1 mV/ 1 mV	0.4 mV/ 4 mV	0.1 mV/ 1 mV	0.25 mV/ 2.5 mV	0.1 mV/ 1 mV	0.25 mV/ 2.5 mV
<b>Programmable slew rate<sup>1</sup></b>							
Current Ranges	Slow band	500 A/s - 25 kA/s	167 A/s - 8330 A/s	1 kA/s - 50 kA/s	1 kA/s - 50 kA/s	2 kA/s - 100 kA/s	500 A/s - 25 kA/s
	Fast band ≥3 V	50 kA/s - 2.5 MA/s	16.7 kA/s - 833 kA/s	100 kA/s - 5 MA/s	100 kA/s - 5 MA/s	200 kA/s - 10 MA/s	50 kA/s - 2.5 MA/s
	Fast band <3 V	50 kA/s - 250 kA/s	16.7 kA/s - 83.3 kA/s	100 kA/s - 500 kA/s	100 kA/s - 500 kA/s	200 kA/s - 1 MA/s	50 kA/s - 250 kA/s
Voltage Ranges	Slow band	1 kV/s - 50 kV/s	4 kV/s - 200 kV/s	1 kV/s - 50 kV/s	2.5 kV/s - 125 kV/s	1 kV/s - 50 kV/s	2.5 kV/s - 125 kV/s
	Fast band ≥3 V	100 kV/s - 500 kV/s	400 kV/s - 2 MV/s	100 kV/s - 500 kV/s	250 kV/s - 1.25 MV/s	100 kV/s - 500 kV/s	250 kV/s - 1.25 MV/s
	Fast band <3 V	100 kV/s - 50 kV/s	400 kV/s - 200 kV/s	100 kV/s - 50 kV/s	250 kV/s - 125 kV/s	100 kV/s - 50 kV/s	250 kV/s - 125 kV/s
Resistance Range 1 Slow band		44 Ω/s - 1125 Ω/s	540 Ω/s - 13.5 kΩ/s	22 Ω/s - 560 Ω/s	55 Ω/s - 1400 Ω/s	11 Ω/s - 280 Ω/s	110 Ω/s - 2800 Ω/s
	Fast band ≥3 V	2250 Ω/s - 34 kΩ/s	27 kΩ/s - 408 kΩ/s	1120 Ω/s - 17 kΩ/s	2800 Ω/s - 42.5 kΩ/s	560 Ω/s - 8.5 kΩ/s	5600 Ω/s - 85 kΩ/s
	Fast band <3 V	2250 Ω/s - 3.4 kΩ/s	27 kΩ/s - 40.8 kΩ/s	1120 Ω/s - 1.7 kΩ/s	2800 Ω/s - 4.25 kΩ/s	560 Ω/s - 850 Ω/s	5600 Ω/s - 8.5 kΩ/s
Resistance Range 2 Slow band		440 Ω/s - 11.25 kΩ/s	5.4 kΩ/s - 135 kΩ/s	220 Ω/s - 5600 Ω/s	550 Ω/s - 14 kΩ/s	110 Ω/s - 2800 Ω/s	1.1 kΩ/s - 28 kΩ/s
	Fast band ≥3 V	22.5 kΩ/s - 340 kΩ/s	270 kΩ/s - 4.08 MΩ/s	11.2 kΩ/s - 170 kΩ/s	28 kΩ/s - 425 kΩ/s	5600 Ω/s - 85 kΩ/s	56 kΩ/s - 850 kΩ/s
	Fast band <3 V	22.5 kΩ/s - 34 kΩ/s	270 kΩ/s - 408 kΩ/s	11.2 kΩ/s - 17 kΩ/s	28 kΩ/s - 42.5 kΩ/s	5600 Ω/s - 8.5 kΩ/s	56 kΩ/s - 85 kΩ/s
Resistance Range 3 Slow band		4.4 kΩ/s - 112.5 kΩ/s	54 kΩ/s - 1.35 MΩ/s	2.2 kΩ/s - 56 kΩ/s	5.5 kΩ/s - 140 kΩ/s	1.1 kΩ/s - 28 kΩ/s	11 kΩ/s - 280 kΩ/s
	Fast band ≥3 V	225 kΩ/s - 3.4 MΩ/s	2.7 MΩ/s - 40.8 MΩ/s	112 kΩ/s - 1.7 MΩ/s	280 kΩ/s - 4.25 MΩ/s	56 kΩ/s - 850 kΩ/s	560 kΩ/s - 8.5 MΩ/s
	Fast band <3 V	225 kΩ/s - 340 kΩ/s	2.7 MΩ/s - 4.08 MΩ/s	112 kΩ/s - 170 kΩ/s	280 kΩ/s - 425 kΩ/s	56 kΩ/s - 85 kΩ/s	560 kΩ/s - 850 kΩ/s
Resistance Range 4 Slow band		44 kΩ/s - 1.125 MΩ/s	540 kΩ/s - 13.5 MΩ/s	22 kΩ/s - 560 kΩ/s	55 kΩ/s - 1.4 MΩ/s	11 kΩ/s - 280 kΩ/s	110 kΩ/s - 2.8 MΩ/s
	Fast band ≥3 V	2.25 MΩ/s - 34 MΩ/s	27 MΩ/s - 408 MΩ/s	1.12 MΩ/s - 17 MΩ/s	2.8 MΩ/s - 42.5 MΩ/s	560 kΩ/s - 8.5 MΩ/s	5.6 MΩ/s - 85 MΩ/s
	Fast band <3 V	2.25 MΩ/s - 3.4 MΩ/s	27 MΩ/s - 40.8 MΩ/s	1.12 MΩ/s - 1.7 MΩ/s	2.8 MΩ/s - 4.25 MΩ/s	560 kΩ/s - 850 kΩ/s	5.6 MΩ/s - 8.5 MΩ/s

 More detailed specifications at [www.agilent.com/find/N3300](http://www.agilent.com/find/N3300)

## Multiple-Input: 150 W to 600 W (Continued)

Table A-2 (Continued)  
Supplemental Characteristics

**Table A-2** lists the supplemental characteristics, which are not warranted but are descriptions of typical performance determined either by design or type testing.

**Notes**

2 Applies to all ranges.

	N3302A	N3303A	N3304A	N3305A	N3306A	N3307A
<b>Programmable short</b>	66 mΩ max.	200 mΩ max.	33 mΩ max.	33 mΩ max.	17 mΩ max.	33 mΩ max.
	40 mΩ typical	100 mΩ typical	20 mΩ typical	25 mΩ typical	12 mΩ typical	20 mΩ typical
<b>Programmable open</b>	≥20 kΩ	≥80 kΩ	≥20 kΩ	≥20 kΩ	≥20 kΩ	≥80 kΩ
<b>Command processing time</b>						
Using discrete commands	3 ms	3 ms	3 ms	3 ms	3 ms	3 ms
Using List commands	1 ms	1 ms	1 ms	1 ms	1 ms	1 ms
<b>List dwell characteristics</b>						
Range	0 - 10 s	0 - 10 s	0 - 10 s	0 - 10 s	0 - 10 s	0 - 10 s
Resolution	1 ms	1 ms	1 ms	1 ms	1 ms	1 ms
Accuracy	5 ms	5 ms	5 ms	5 ms	5 ms	5 ms
<b>Measurement time</b>						
1000 samples (default)	20 ms (with specified measurement accuracy)	20 ms (with specified measurement accuracy)	20 ms (with specified measurement accuracy)	20 ms (with specified measurement accuracy)	20 ms (with specified measurement accuracy)	20 ms (with specified measurement accuracy)
200 samples	10 ms (with <6% additional fixed offset)	10 ms (with <6% additional fixed offset)	10 ms (with <6% additional fixed offset)	10 ms (with <6% additional fixed offset)	10 ms (with <6% additional fixed offset)	10 ms (with <6% additional fixed offset)
100 samples	9 ms (with <10% additional fixed offset)	9 ms (with <10% additional fixed offset)	9 ms (with <10% additional fixed offset)	9 ms (with <10% additional fixed offset)	9 ms (with <10% additional fixed offset)	9 ms (with <10% additional fixed offset)
20 points	7 ms (with <30% additional fixed offset)	7 ms (with <30% additional fixed offset)	7 ms (with <30% additional fixed offset)	7 ms (with <30% additional fixed offset)	7 ms (with <30% additional fixed offset)	7 ms (with <30% additional fixed offset)
<20 points	7 ms (with >30% additional fixed offset)	7 ms (with >30% additional fixed offset)	7 ms (with >30% additional fixed offset)	7 ms (with >30% additional fixed offset)	7 ms (with >30% additional fixed offset)	7 ms (with >30% additional fixed offset)
<b>Ripple and noise (20 Hz - 10 MHz)</b>						
Current (rms/peak to peak)	2 mA/20 mA	1 mA/10 mA	4 mA/40 mA	4 mA/40 mA	6 mA/60 mA	2 mA/20 mA
Voltage (rms)	5 mV <sub>rms</sub>	12 mV <sub>rms</sub>	6 mV <sub>rms</sub>	10 mV <sub>rms</sub>	8 mV <sub>rms</sub>	10 mV <sub>rms</sub>
<b>External analog programming</b>						
Voltage Programming Accuracy <sup>2</sup>	0.5% + 12 mV	0.5% + 48 mV	0.5% + 12 mV	0.5% + 30 mV	0.5% + 12 mV	0.5% + 30 mV
Current Programming Accuracy <sup>2</sup>	0.25% + 4.5 mA	0.25% + 1.5 mA	0.25% + 9 mA	0.25% + 9 mA	0.25% + 18 mA	0.25% + 4.5 mA
<b>External monitor ports</b>						
Voltage Monitor Accuracy	0.25% + 12 mV	0.25% + 48 mV	0.25% + 12 mV	0.25% + 30 mV	0.25% + 12 mV	0.25% + 30 mV
Current Monitor Accuracy	0.1% + 4.5 mA	0.1% + 1.5 mA	0.1% + 9 mA	0.1% + 9 mA	0.1% + 18 mA	0.1% + 4.5 mA

More detailed specifications at [www.agilent.com/find/N3300](http://www.agilent.com/find/N3300)



Multiple-Input: 150 W to 600 W (Continued)

Table A-3  
Supplemental Characteristics

Application Notes:

Agilent AN 372-1 Power Supply Testing  
(AN 372-1)  
5952-4190

Agilent AN 372-2 Battery Testing  
(AN 372-2)  
5952-4191

Increasing DC Power Supply Test System  
Throughput with Agilent Technologies  
N3300A DC Electronic Loads  
5980-0233E

Agilent Zero Volt Electronic Load  
5968-6360E

Making Fuel Cell AC Impedance  
Measurements Utilizing  
Agilent N3300A Series Electronic Loads  
5988-5358EN

	N3300A	N3301A
Operating temperature range	0°C to 55°C	0°C to 55°C
Input ratings		
Operating range	100 - 250 Vac 48 - 63 Hz	100 - 250 Vac 48 - 63 Hz
Input Current	4.2 A @ 100 - 127 Vac 2.2 A @ 200 - 250 Vac	2.3 A @ 100 - 250 Vac
Input VA	440 VA	230 VA
Inrush Current	38 A	18 A @ 115 Vac 36 A @ 230 Vac

Supplemental Characteristics  
for all model numbers

Analog Programming Bandwidth:  
10 kHz (-3 db frequency) in CC mode only

Analog Programming Voltage:  
Voltage: 0 - 10 V  
Current: 0 - 10 V

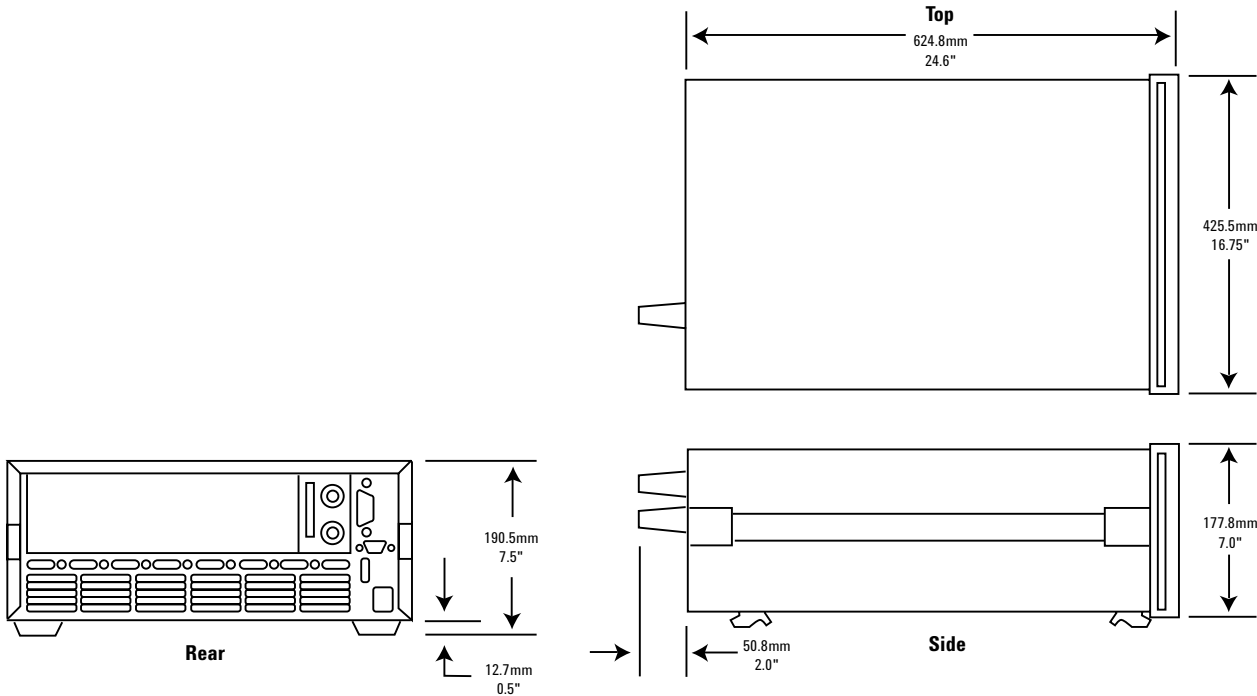
Analog Monitor Ports:  
Voltage: 0 - 10 V  
Current: 0 - 10 V

Remote Sensing:  
5 V DC between sense and load input

Digital/Trigger Inputs  
Vil = 0.9 V max at Iil = -1 mA  
Vih - 3.15 V min  
(pull-up resistor on input)

Digital/Trigger Outputs  
Vol = 0.72 V max at Iol = 1 mA  
Voh = 4.4 V min at Ioh = -20 µA

Agilent Models: N3300A



More detailed specifications at [www.agilent.com/find/N3300](http://www.agilent.com/find/N3300)

## Multiple-Input: 150 W to 600 W (Continued)

### Software Driver:

VXIPlug&Play

### Net Weight:

N3300A: 13.2 kg (29 lb); N3301A: 7.3 kg (16 lb); N3302A, N3303A or N3304A: 2.7 kg (6 lb); N3305A or N3306A: 4.6 kg (10 lb), N3307A 2.7 kg (6 lb)

### Shipping Weight:

N3300A: 17 kg (38 lb); N3301A: 9.1 kg (20 lb) N3302A, N3303A, or N3304A: 4.1 kg (9 lb) N3305A or N3306A: 6.8 kg (15 lb), N3307A 4.1 kg (9 lb)

**Warranty:** One year

### Ordering Information

**Opt. UJG:** Standard finger twist connector

**Opt. UJ1:** 8 mm screw terminal connector (available on all load modules N3302A-N3307A)

**Opt. 800:** Rack-mount kit for two N3301A Mainframes mounted side-by-side (p/n 5061-9694 and 5062-3978).

**Opt. 908:** Rack-mount kit (Two p/n 5062-3974C for a N3300A, or p/n 5062-3960 for one N3301A). For the N3301A, the kit includes a blank filler panel.

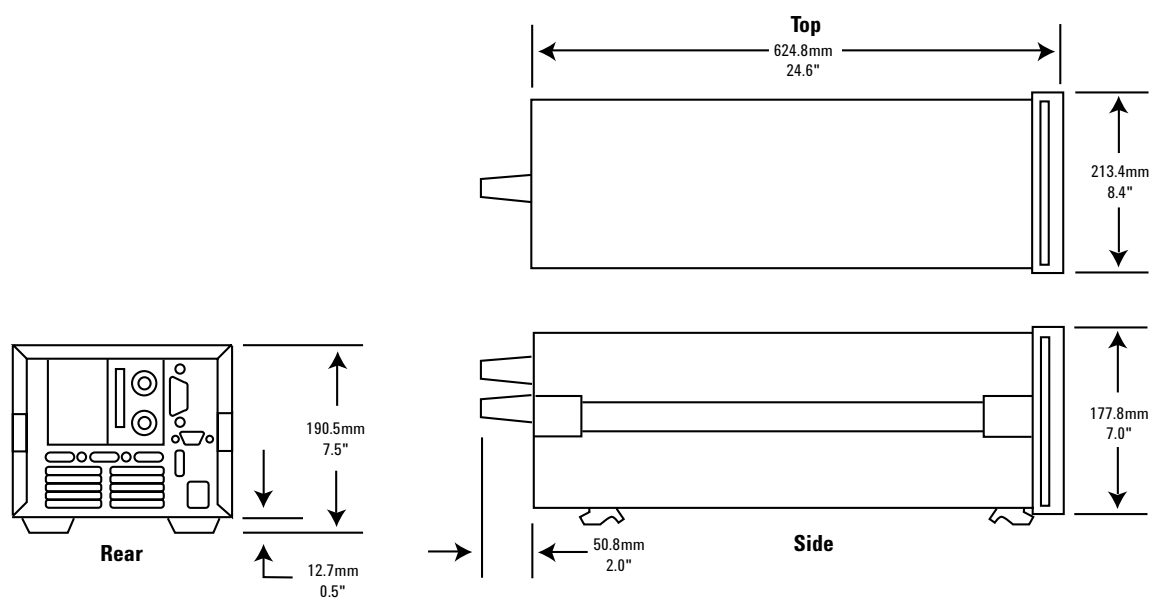
**Opt. 909:** Rack-mount kit with handles for N3300A (Two p/n 5062-3975 and 5063-9219)

**Opt 0L1** Full documentation on CD-ROM, and printed standard documentation package

**Opt 0L2** Extra copy of standard printed documentation package

**Opt 0B0** Full documentation on CD-ROM only

### Agilent Models: N3301A



More detailed specifications at [www.agilent.com/find/N3300](http://www.agilent.com/find/N3300)



6060B and 6063B

## Single-Input 250 W to 300 W

Cost-effective for single input applications

Convenient optional front panel input connection

The 6060B and 6063B each provides one load input. This is more convenient for single input applications than a mainframe product.

These electronic loads are particularly suited for the lab bench. Entering commands manually using the front panel keypad is simpler because the channel does not need to be specified, as in a mainframe configuration. The keypad entry is further simplified because these products do not have the downloadable LIST feature of the N3300A Series, which helps to maximize production throughput. Extensive protection is included to help protect your valuable prototypes under test. This includes overvoltage, overcurrent, overtemperature, overpower, and reverse polarity.

These loads are suitable for manufacturing test systems where maximizing speed is not critical. They use industry standard SCPI instructions, and also have *VXIPlug&Play* drivers to simplify system design. For the greatest speed and accuracy in programming and measurement, see the N3300A Series of DC electronic loads.

Specifications	6060B	6063B
<b>Amperes</b>	0 to 60 A	0 to 10 A
<b>Volts</b>	3 to 60 V	3 to 240 V
<b>Maximum power</b> (at 40° C)	300 W	250 W
<b>Constant current mode</b>		
Ranges	0 to 6 A, 0 to 60 A	0 to 1 A, 0 to 10 A
Accuracy	0.1% ±75 mA	0.15% ±10 mA
Regulation	10 mA	8 mA
<b>Constant voltage mode</b>		
Accuracy	0.1% ±50 mV	0.12% ±120 mV
Regulation (w/remote sense)	10 mV	10 mV
<b>Constant resistance mode</b>	0.033 to 1.0 Ω	0.20 to 24.0 Ω
Ranges	1 to 1,000 Ω 10 to 10,000 Ω	24 to 10,000 Ω 240 to 50,000 Ω
Accuracy	1 Ω: 0.8% ±8 mΩ (with ≥6 A at input) 1 KΩ: 0.3% ±8 mS (with ≥6 V at input) 10 KΩ: 0.3% ±8 mS (with ≥6 V at input)	24 Ω: 0.8% ±200 mΩ (with ≥1 A at input) 10 KΩ: 0.3% ±0.3 mS (with ≥24 V at input) 50 KΩ: 0.3% ±0.3 mS (with ≥24 V at input)
<b>Transient generator</b>		
Frequency range	0.25 Hz to 10 kHz	0.25 Hz to 10 kHz
Accuracy	3%	3%
Duty cycle range	3 to 97% (0.25 Hz to 1 kHz) 6 to 94% (1 to 10 kHz)	3 to 97% (0.25 Hz to 1 kHz) 6 to 94% (1 to 10 kHz)
Accuracy	6% of setting ±2%	6% of setting ±2%
Current level high range	60-A range:	10-A range:
Accuracy	0.1% ±350 mA	0.18% ±50 mA
Current level low range	6-A range:	1-A range:
Accuracy	0.1% ±80 mA	0.18% ±13 mA
Voltage level	3 to 60 V	3 to 240 V
Voltage level accuracy	0.1% ±300 mV	0.15% ±1.1 V
<b>Readback specifications</b>		
Current readback accuracy	0.05% ±65 mA	0.12% ±10 mA
Voltage readback accuracy	±(0.05% + 45 mV)	±(0.1% + 150 mV)
<b>Ripple and noise</b> (20-Hz to 10-MHz noise)		
Current	4 mA rms 40 mA peak-to-peak	1 mA rms 10 mA peak-to-peak
Voltage	6 mV rms	6 mV rms

## Single-Input: 250 W to 300 W (Continued)

## Specifications

6060B

6063B

## Notes:

1. Operating temperature range is 0° to 55°C. All specifications apply for 25°C  $\pm$  5°C, except as noted.
2. Maximum continuous power available is derated linearly from 40°C to 75% of maximum at 55°C.
3. DC current accuracy specifications apply 30 seconds after input is applied.

## Supplemental Characteristics

(Non-warranted characteristics determined by design that are useful in applying the product)

<b>Constant current mode</b>	60-A range: 16 mA	10-A range: 2.6 mA
Resolution	6-A range: 1.6 mA	1-A range: 0.26 mA
Temperature coefficient	100 ppm/°C $\pm$ 5 mA/°C	150 ppm/°C $\pm$ 1 mA/°C
<b>Constant voltage mode</b>		
Resolution	16 mV	64 mV
Temperature coefficient	100 ppm/°C $\pm$ 5 mV/°C	120 ppm/°C $\pm$ 10 mV/°C
<b>Constant resistance mode</b>		
Resolution	1 $\Omega$ : 0.27 m $\Omega$ 1 K $\Omega$ : 0.27 mS 10 K $\Omega$ : 0.027 mS	24 $\Omega$ : 6 m $\Omega$ 10 K $\Omega$ : 0.011 mS 50 K $\Omega$ : 0.001 mS
Temperature coefficient	1 $\Omega$ : 800 ppm/°C $\pm$ 0.4 m $\Omega$ /°C 1 K $\Omega$ : 300 ppm/°C $\pm$ 0.6 mS/°C 10 K $\Omega$ : 300 ppm/°C $\pm$ 0.6 mS/°C	24 $\Omega$ : 800 ppm/°C $\pm$ 10 m $\Omega$ /°C 10 K $\Omega$ : 300 ppm/°C $\pm$ 0.03 mS/°C 50 K $\Omega$ : 300 ppm/°C $\pm$ 0.03 mS/°C
<b>Transient generator</b>		
Frequency range	0.25 Hz to 10 kHz	0.25 Hz to 10 kHz
Resolution	4% or less	4% or less
Duty cycle range	3 to 97% (0.25 Hz to 1 kHz) 6 to 94% (1 to 10 kHz)	3 to 97% (0.25 Hz to 1 kHz) 6 to 94% (1 to 10 kHz)
Resolution	4%	4%
Current level high range	60-A range: 260 mA	10-A range: 43 mA
Current level low range	6-A range: 26 mA	1-A range: 4 mA
Current temperature coefficient	100 ppm/°C $\pm$ 7 mA/°C	180 ppm/°C $\pm$ 1.2 mA/°C
Voltage level resolution	260 mV	1 V
Voltage temperature coefficient	150 ppm/°C $\pm$ 5 mV/°C	120 ppm/°C $\pm$ 10 mV/°C
Programmable slew rate	60-A range: 1 A/ms to 5 A/ $\mu$ s 6-A range: 0.1 A/ms to 0.5 A/ $\mu$ s	10-A range: 0.17 A/ms to 0.83 A/ $\mu$ s 1-A range: 17 A/ms to 83 A/ms
Rise/fall time	12 $\mu$ s to 8 ms	16 $\mu$ s to 8 ms
<b>Analog programming bandwidth</b>	10 kHz (–3 dB frequency)	10 kHz (–3 dB frequency)
<b>Analog programming accuracy</b>		
Current (low range)	4.5% $\pm$ 75 mA	3% $\pm$ 8 mA
Current (high range)	4.5% $\pm$ 250 mA	3% $\pm$ 20 mA
Temperature coefficient	100 ppm/°C $\pm$ 6 mA/°C	150 ppm/°C $\pm$ 1 mA/°C
Voltage	0.8% $\pm$ 200 mV	0.5% $\pm$ 150 mV
Temperature coefficient	100 ppm/°C $\pm$ 1 mV/°C	120 ppm/°C $\pm$ 10 mV/°C
<b>Analog programming voltage</b>	0 to 10 V	0 to 10 V
<b>Readback specifications</b>		
Current readback resolution	17 mA (via GPIB) 20 mA (front panel)	2.7 mA (via GPIB) 10 mA (front panel)
Temperature coefficient	50 ppm/°C $\pm$ 5 mA/°C	100 ppm/°C $\pm$ 1 mA/°C
Voltage readback resolution	17 mV (via GPIB) 20 mV (front panel)	67 mV (via GPIB) 100 mV (front panel)
Temperature coefficient	50 ppm/°C $\pm$ 1.2 mV/°C	100 ppm/°C $\pm$ 8 mV/°C

More detailed specifications at [www.agilent.com/find/6060](http://www.agilent.com/find/6060)

## Single-Input: 250 W to 300 W (Continued)

## Specifications

6060B

6063B

## Notes:

1. Operating temperature range is 0° to 55°C. All specifications apply for 25°C ±5°C, except as noted.
2. Maximum continuous power available is derated linearly from 40°C to 75% of maximum at 55°C.
3. DC current accuracy specifications apply 30 seconds after input is applied.

## Supplemental Characteristics

(Non-warranted characteristics determined by design that are useful in applying the product)

Supplemental Characteristics (Continued)		
<b>Analog monitor accuracy</b>		
Current monitor (0 to 10 V out)	4% ±85 mA	3% ±10 mA
Temperature coefficient	50 ppm/°C ±6 mA/°C	100 ppm/°C ±1 mA/°C
Voltage monitor (0 to 10 V out)	0.25% ±40 mV	0.4% ±240 mV
Temperature coefficient	50 ppm/°C ±0.2 mV/°C	70 ppm/°C ±1.2 mV/°C
<b>Remote sensing</b>		
	5-Vdc maximum between sense and load input	5-Vdc maximum between sense and load input
<b>Minimum operating voltage</b> (at full rated current)		
	2 volts (1.2 V typical)	2 volts (1.2 V typical)
<b>Programmable short</b>		
	0.033 Ω (0.020 Ω typical)	0.20 Ω (0.10 Ω typical)
<b>Programmable open (typical)</b>		
	20 kΩ	80 kΩ
<b>Drift</b> (over 8-hour interval)		
Current	0.03% ±10 mA	0.03% ±15 mA
Voltage	0.01% ±10 mV	0.01% ±20 mV
<b>DC isolation voltage</b>		
	±240 Vdc, between any input and chassis ground	±240 Vdc, between any input and chassis ground
<b>Digital inputs</b>		
	V <sub>IL</sub> = 0.9 V max at I <sub>IL</sub> = -1 mA / V <sub>IH</sub> = 3.15 V min (pull-up resistor on input)	V <sub>IL</sub> = 0.9 V max at I <sub>IL</sub> = -1 mA / V <sub>IH</sub> = 3.15 V min (pull-up resistor on input)
<b>Digital outputs</b>		
	V <sub>OL</sub> = 0.72 V max at I <sub>OL</sub> = 1 mA / V <sub>OH</sub> = 4.4 V min at I <sub>OH</sub> = -20 μA	V <sub>OL</sub> = 0.72 V max at I <sub>OL</sub> = 1 mA / V <sub>OH</sub> = 4.4 V min at I <sub>OH</sub> = -20 μA
<b>Net weight</b> (approx.)		
	6.12 kg (13.5 lb)	6.12 kg (13.5 lb)
<b>Shipping weight</b>		
	8.16 kg (18 lb)	8.16 kg (18 lb)

## Single-Input: 250 W to 300 W (Continued)

### Application Notes:

**Agilent AN 372-1 Power Supply Testing**  
(AN 372-1)  
5952-4190

**Agilent AN 372-2 Battery Testing**  
(AN 372-2)  
5952-4191

**Pulsed Characterization of Power Semiconductors Using Electronic Loads**  
(AN 1246)  
5091-7636E

### Supplemental Characteristics for all model numbers

**Software Driver:**  
VXIPlug&Play

**Weight:** 6.12 kg (13.5 lb) net; 8.16 kg (18 lb) shipping

**Size:** 425.5 mm W x 88.1 mm H x 396 mm D (16.75 in x 3.5 in x 13.7 in)

**Warranty:** One year

### Ordering Information

**Opt 020** Front Panel DC Input Connectors

**Opt 100** 87 to 106 Vac, 47 to 66 Hz input (for Japan only)

**Opt 120** 104-127 Vac, 47 to 66 Hz

**Opt 220** 191 to 233 Vac, 47 to 66 Hz input

**Opt 240** 209 to 250 Vac, 47 to 66 Hz input

**\* Opt 908** Rack-mount Kit (p/n 5062-3974C)

**\* Opt 909** Rack-mount Kit with Handles (p/n 5063-9219)

**Opt 0L1** Full documentation on CD-ROM, and printed standard documentation package

**Opt 0L2** Extra copy of standard printed documentation package

**Opt 0B0** Full documentation on CD-ROM only

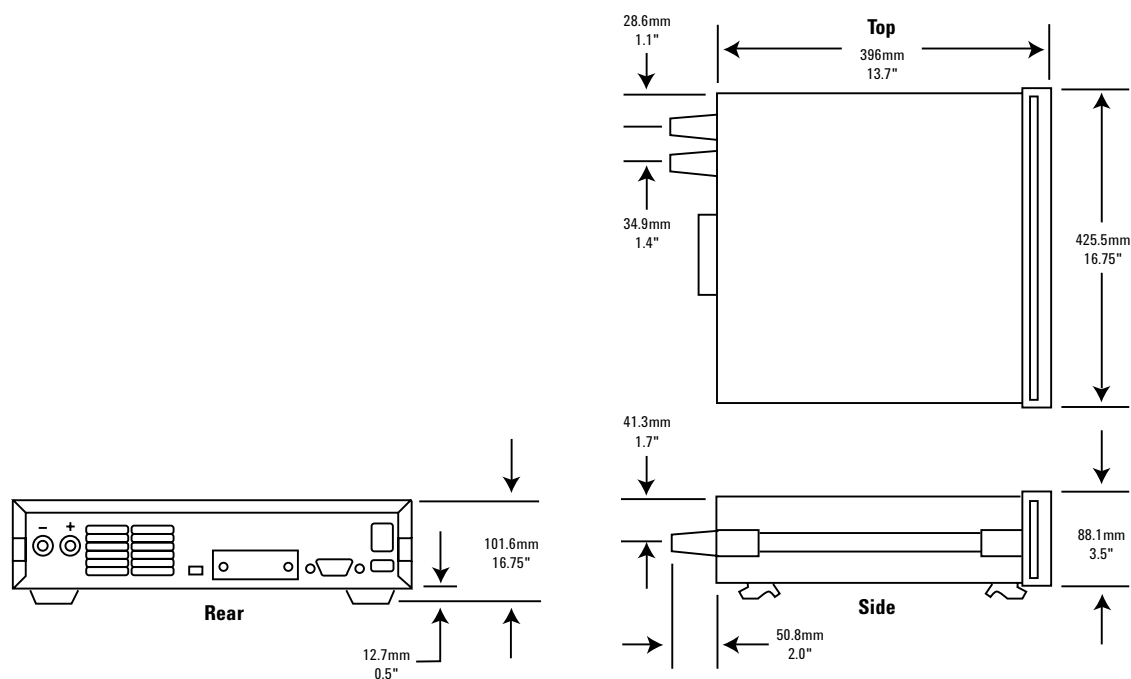
**Opt 0B3** Service Manual

\* Support rails required

### Accessories

**E3663AC** Support rails for Agilent rack cabinets

**Agilent Models: 6060B, 6063B**



More detailed specifications at [www.agilent.com/find/6060](http://www.agilent.com/find/6060)

# AC Power Source/Analyzers...

an integrated  
AC power solution

Agilent AC Power Source/Analyzers provide a complete AC test solution. As AC sources, they combine the capabilities of a power amplifier and an arbitrary waveform generator. This allows you to simulate normal waveforms and many types of distorted power waveforms. The built-in power analyzer combines the capabilities of a multimeter, oscilloscope, harmonic analyzer and power analyzer. These instruments may also be used to produce DC power, either alone or as a DC offset to an AC waveform.

## AC Power Source/Analyzers 375-1750 VA



6811B, 6812B, 6813B

Provides a complete AC and DC power and measurement solution  
Protect valuable DUTs with extensive protection features  
Easy to use Graphical User Interface (GUI)

### The Complete AC Power Test Solution

Since your product will have to operate in the real world of unpredictable AC power, you need to design and verify its correct operation under a wide range of AC power inputs. Brownouts, dropouts, sags, and other irregularities are not unusual in many communities today. Agilent AC sources have the features needed to easily accomplish this test goal either in an R&D environment or on the manufacturing test floor. If you plan to sell your products in a worldwide market, you will also need to test them at the line voltages and frequencies that they will eventually operate at. There is also additional testing needed to meet regulatory requirements for sale into some countries.

Agilent AC sources offer a complete solution for AC power testing, helping you to simplify this important task. These instruments combine the features of a power amplifier and arbitrary waveform generator to give you the ability to do all of the tests that you need. There are many standard preprogrammed waveforms, or you can use the

transient generation system to simulate sophisticated and repeatable AC line disturbances. DC power can also be generated, either as a DC offset or as a pure DC signal.

### Powerful Built-in Measurement Capabilities

Agilent AC sources have extensive 16-bit precision measurement capabilities which would normally require a number of complex measurement instruments, including a DMM (digital multimeter), oscilloscope, power analyzer, and harmonic analyzer. The precision measurements include:

- rms, DC, AC + DC voltage and current
- peak voltage and current
- real, apparent, and reactive power
- harmonic analysis of voltage and current waveforms providing amplitude and phase up to the 50th harmonic
- THD (total harmonic distortion)
- Triggered acquisition of digitized voltage and current

Using the measurement capabilities of an Agilent AC source simplifies your test setups and helps you obtain accurate data quickly.

### Dual Power Analyzer Option 020

The powerful built-in power meter/analyzer in Agilent AC sources provides everything that you need to make AC measurements at the AC input to your DUT. For many test scenarios, this is the extent of the AC analysis required.

Some test scenarios, however, require AC measurements to be made at both the AC input and the AC output of the DUT. Option 020 provides an additional power analyzer, complete with a precision current shunt, which can be connected anywhere you need it. This second analyzer can even be used for tests where the AC source is not providing power, thus expanding the usefulness of this instrument to many more test configurations. The additional analyzer is equivalent in specifications and capabilities to the standard analyzer.



## AC Power Source/Analyzers: 375-1750 VA (Continued)

Using the dual power analyzer option instead of an additional power analyzer instrument externally is more than just convenient. Measurements on all four measurement channels (AC source output voltage and current, and dual power analyzer voltage and current inputs) are inherently synchronized with the AC source output waveform. This precision would be difficult to achieve using separate measurement instruments.

### Examples Dual Power Analyzer Applications

- Complete testing of uninterruptible power sources (UPS)
- Efficiency testing of DC power supplies
- Efficiency testing of AC power sources
- Efficiency testing of transformers
- Safety testing of transformers
- Line disturbance and brownout testing of DC power supplies
- Line disturbance and brownout testing of AC power sources
- Sleep mode current monitoring
- Independent power analyzer

### Sleep Mode Current Monitoring

Many electronic products have power-saving or sleep modes. In this mode, the device draws only enough power to be able to recognize a “wake-up” signal, and then execute a smooth “wake-up”. The power drawn in this mode is a critical parameter, and the ability to accurately monitor it is important.

The accessory precision current shunt that is supplied with option 020 is mounted in such a way to make it easy for you to replace it with a precision resistor of your choice. By doing this, you can configure the system to accurately monitor extremely low currents. This provides an easy way for you to profile the current draw in all modes of your product’s operation. Since Agilent 6811B-6813B AC sources produce DC power as well as AC power, portable battery operated products can also be tested with this configuration.

### UPS (uninterruptible power source) Testing

The Dual Power Analyzer Option provides many important benefits for UPS testing. Since the key to correct UPS operation is having the output react properly to changes on the input, being able to monitor the output relative to the input simplifies testing. For example, commands are available to enable calculation of UPS transfer time, and the phase difference between the UPS input and output voltage. Agilent AC sources also have programmable output impedance, enabling the UPS designer to verify product stability over a wide range of AC line impedance.

### Free Graphical User Interface (GUI)

When you need to run a variety of tests, study the results carefully, and then run more tests with slightly varied conditions, writing computer programs using the extensive SCPI command set may seem burdensome. This is when you should download the latest copy of the Free Agilent AC Source Graphical User Interface from [www.agilent.com](http://www.agilent.com).

The Agilent AC source GUI makes it quick and easy to set the output of your Agilent AC source, be it from a stored waveform or with a waveform that you create using your mouse. The GUI also allows you to see the output of the AC source in graphical form, save the results, or dump them directly into a Microsoft Excel file.

### Microsoft Excel Link

The direct Excel link feature was recently added to meet the current needs of R&D engineers. It makes it easy to keep the results of many tests, and makes them easily retrievable. With it, the test records resulting from changing conditions can be kept in one place and easily compared.

Access to raw data often helps in fully understanding test results. For example, small local peaks may not be evident in processed data. V, I and phase results from harmonic measurements are particularly susceptible to not showing the complete story in a graphical representation.

## AC Power Source/Analyzers: 375-1750 VA (Continued)

Microsoft Excel offers a wide variety of data manipulation and graphical capabilities that can help an engineer gain the fullest understanding from the test data.

### Test Suite for Avionics Equipment

Agilent AC sources are well suited for testing equipment intended for use in the avionics industry which operate at nominally 400 Hz. One of the special requirements that many manufacturers in this industry must concern themselves with is testing to meet RTCA DO-160 standards. These standards involve both AC and DC immunity tests. The Agilent AC source GUI includes a section devoted to these tests. By using this tool, you can quickly step through the required set-ups with confidence.

### Extensive protection to prevent load damage

In addition to overcurrent, overvoltage, overpower and overtemperature protection, the 6800 series offers output disconnect relays and remote inhibit capability (quickly

disabling the output of the AC source via a TTL signal) to protect the device under test.

The 6800 series is backed by a three-year warranty and Agilent's worldwide network of support and service centers.

### Application info

The 6800 series can help you test and improve your products.

You can easily perform:

1. Static testing—generating and measuring voltage, frequency, and line current for meeting worldwide specifications.
2. Dynamic testing—generating AC line transients for limit testing and design verification.
3. Specialty testing—measuring current harmonic content and creating custom AC power waveforms (such as a combined AC + DC signal to simulate a telephone ring).
4. Precompliance regulatory testing—measuring current harmonics, voltage fluctuations and flicker emissions and generating voltage and frequency disturbances and interharmonics to determine product immunity.

Development engineers and test professionals in a wide variety of industries use AC power source/analyzers. Here are a few examples:

#### Avionics

Instrumentation, ATE test stations

#### Computer Products

Computers, Monitors, Peripherals

#### Consumer Products

Home appliances, Audio and video equipment, Heating/cooling controls

#### Electrical Products

Relays, Transformers, Power components, Fire alarms

#### Lighting Products

Electronic ballasts, Compact fluorescent bulbs, Timers

#### Motors

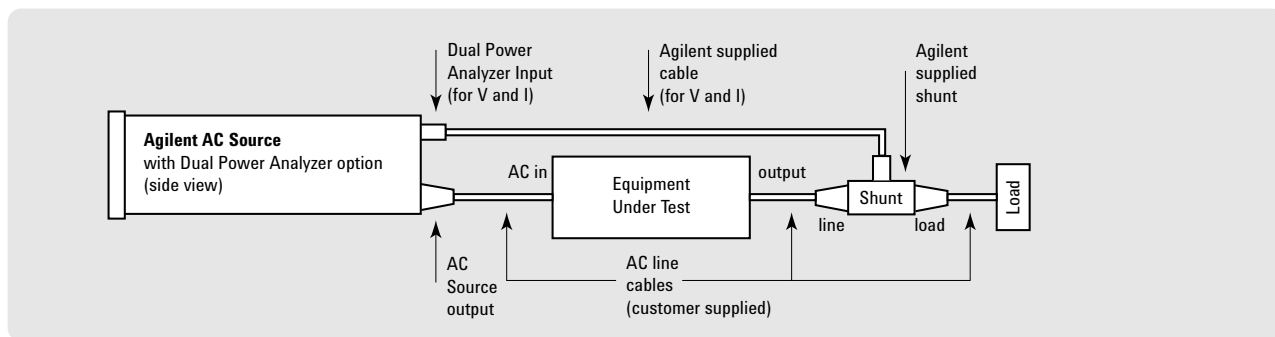
AC motors, Electronic controllers

#### Power Products

AC/DC adapters, AC/DC power supplies, PBX power supplies, Uninterruptible power supplies

#### Telecom Products

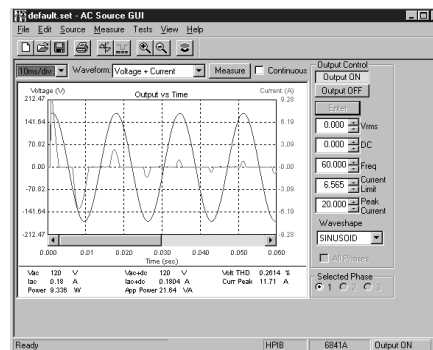
RF amplifiers, CATV devices, MUX's, routers, switches



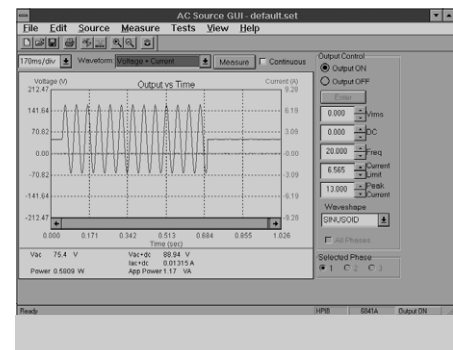
Test configuration of efficiency measurement using an Agilent AC source with the 020 Dual Power Analyzer Option.

## AC Power Source/Analyzers: 375-1750 VA (Continued)

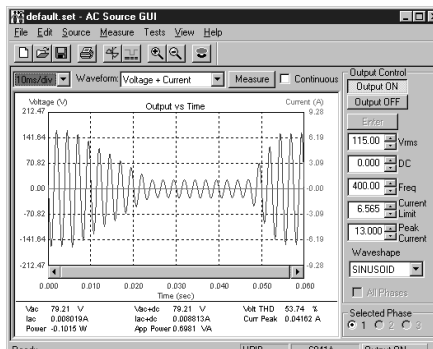
### AC Source Graphical User Interface



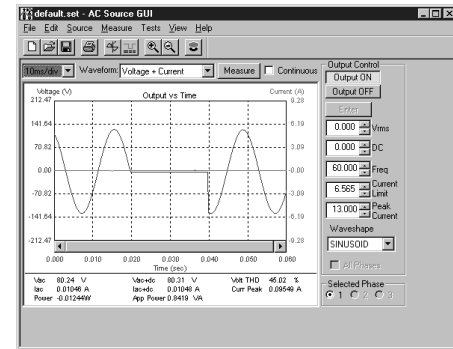
Inrush Current Measurement



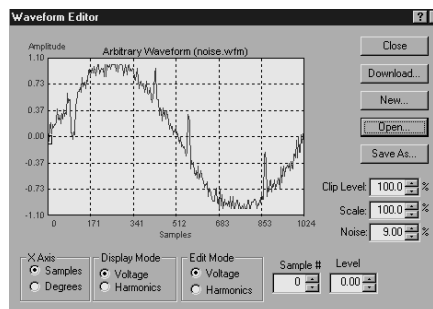
Ringer Voltage (DC + AC) Generation



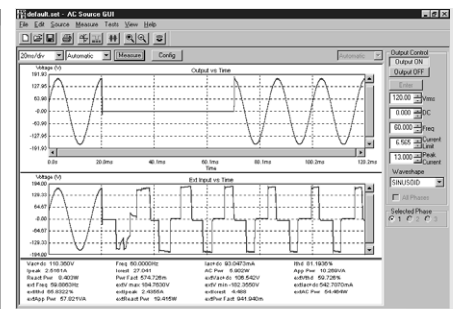
Voltage Slew Control (Brownout)



One cycle AC Mains Dropout



User Defined Waveform: Noise with Spikes



Testing of UPS Input and Output  
using Dual Power Analyzer Option 020

## AC Power Source/Analyzers: 375-1750 VA (Continued)

For a sine wave with a resistive load at 0° to 40° C, within an output frequency range of 45 Hz to 1000 Hz, and in AC coupled mode after a 30 minute warm-up unless otherwise noted.

### Notes:

1 Product may be operated between DC and 45 Hz subject to certain deratings. Measurements may be extended to 4.5 Hz at full accuracy only by selecting a digitization rate of 250  $\mu$  seconds per point. Frequency content of the measured signal must be limited to 4 k Hz or less to avoid aliasing effects.

Specifications (at 0° to 55° C unless otherwise specified)	6811B	6812B	6813B
Number of phases	1	1	1
Output ratings (Maximum)			
Power	375 VA	750 VA	1750 VA
rms voltage	300 V	300 V	300 V
rms current	3.25 A	6.5 A	13 A
Repetitive & non-repetitive peak current	40 A	40 A	80 A
Crest factor	12	6	6
Load Power factor capability	0 to 1	0 to 1	0 to 1
DC power	285 W	575 W	1350 W
DC voltage	$\pm 425$ V	$\pm 425$ V	$\pm 425$ V
DC current	2.5 A	5.0 A	10.0 A
Output frequency range <sup>1</sup>	DC; 45 Hz to 1 kHz	DC; 45 Hz to 1 kHz	DC; 45 Hz to 1 kHz
Constant voltage ripple and noise (20 kHz to 10 MHz)	-60 dB (relative to full scale)	-60 dB (relative to full scale)	-60 dB (relative to full scale)
Line regulation (% of full scale)	0.1%	0.1%	0.1%
Load regulation (% of full scale)	0.5%	0.5%	0.5%
Maximum total harmonic distortion	0.25% at 50/60 Hz 1% worst case 45 to 1 kHz	0.25% at 50/60 Hz 1% worst case 45 to 1 kHz	0.25% at 50/60 Hz 1% worst case 45 to 1 kHz
Programming accuracy	(25° $\pm$ 5°C)		
RMS voltage (% of output + offset)	0.15% + 0.3 V (45 - 100Hz) 0.5% + 0.3 V (>100 - 500 Hz) 1% + 0.3 V (> 500 - 1000 Hz)	0.15% + 0.3 V (45 - 100Hz) 0.5% + 0.3 V (>100 - 500 Hz) 1% + 0.3 V (> 500 - 1000 Hz)	0.15% + 0.3 V (45 - 100Hz) 0.5% + 0.3 V (>100 - 500 Hz) 1% + 0.3 V (> 500 - 1000 Hz)
DC voltage	0.1% + 0.5 V	0.1% + 0.5 V	0.5% + 0.3 V
Frequency	0.01% + 10 $\mu$ Hz	0.01% + 10 $\mu$ Hz	0.01% + 10 $\mu$ Hz

## AC Power Source/Analyzers: 375-1750 VA (Continued)

### Specifications

(at 0° to 55° C unless  
otherwise specified)

6811B

6812B

6813B

For a sine wave with a resistive load at 0° to 40° C, within an output frequency range of 45 Hz to 1000 Hz, and in AC coupled mode after a 30 minute warm-up unless otherwise noted.

#### Notes:

1 Product may be operated between DC and 45 Hz subject to certain deratings. Measurements may be extended to 4.5 Hz at full accuracy only by selecting a digitization rate of 250  $\mu$  seconds per point. Frequency content of the measured signal must be limited to 4 k Hz or less to avoid aliasing effects.

2 Select low measurement range for improved accuracy (10:1) for lower power measurements.

### Measurement Accuracy

(25°C  $\pm$  55°C)

<b>Rms. voltage (45 - 100 Hz)</b>	0.03% + 100 mV <sup>1</sup>	0.03% + 100 mV <sup>1</sup>	0.03% + 100 mV <sup>1</sup>
<b>DC voltage</b>	0.05% + 150 mV <sup>1</sup>	0.05% + 150 mV <sup>1</sup>	0.05% + 150 mV <sup>1</sup>
<b>RMS current (45 - 100 Hz)<sup>2</sup></b>			
high range	0.05% + 10 mA	0.05% + 10 mA	0.05% + 10 mA
low range	0.05% + 1.5 mA	0.05% + 1.5 mA	0.05% + 1.5 mA
<b>Power (VA) (45-100 Hz)<sup>2</sup></b>			
high range	0.1% + 1.5 VA + 12 mVA/V	0.1% + 1.5 VA + 12 mVA/V	0.1% + 1.5 VA + 12 mVA/V
low range	0.1% + 1.5 VA + 1.2 mVA/V	0.1% + 1.5 VA + 1.2 mVA/V	0.1% + 1.5 VA + 1.2 mVA/V
<b>Power (watts) (45-100 Hz)<sup>2</sup></b>			
high range	0.1% + 0.3 W + 12 mW/V	0.1% + 0.3 W + 12 mW/V	0.1% + 0.3 W + 12 mW/V
low range	0.1% + 0.3 W + 1.2 mW/V	0.1% + 0.3 W + 1.2 mW/V	0.1% + 0.3 W + 1.2 mW/V
<b>Frequency</b>	0.01% + 0.01 Hz	0.01% + 0.01 Hz	0.01% + 0.01 Hz
<b>Power factor</b>	0.01	0.01	0.01
<b>Current magnitude</b> Fundamental	0.03% + 1.5 mA	0.03% + 1.5 mA	0.03% + 1.5 mA
Low range Harmonics 2-49	0.03% + 1 mA + 0.2%/kHz	0.03% + 1 mA + 0.2%/kHz	0.03% + 1 mA + 0.2%/kHz
<b>Current magnitude</b> Fundamental	0.05% + 5 mA	0.05% + 5 mA	0.05% + 5 mA
High range Harmonics 2-49	0.05% + 3 mA + 0.2%/kHz	0.05% + 3 mA + 0.2%/kHz	0.05% + 3 mA + 0.2%/kHz

### Supplemental Characteristics

(Non-warranted characteristics determined by design that are useful in applying the product)

<b>Average programming accuracy</b> (% of output + offset) rms current	1.2% + 50 mA	1.2% + 50 mA	1.2% + 50 mA
<b>Average programming resolution</b>			
rms voltage	125 mV	125 mV	125 mV
DC voltage	250 mV	250 mV	250 mV
Overvoltage programming (OVP)	2 V peak	2 V peak	2 V peak
rms current	2 mA	4 mA	4 mA
peak current	12.5 mA	25 mA	25 mA
output frequency	10 $\mu$ Hz	10 $\mu$ Hz	10 $\mu$ Hz
phase	N/A	N/A	N/A

More detailed specifications at [www.agilent.com/find/6800](http://www.agilent.com/find/6800)

## AC Power Source/Analyzers: 375-1750 VA (Continued)

### Specifications

(at 0° to 55° C unless  
otherwise specified)

6811B

6812B

6813B

For a sine wave with a resistive load at 0° to 40° C, within an output frequency range of 45 Hz to 1000 Hz, and in AC coupled mode after a 30 minute warm-up unless otherwise noted.

#### AC Input Ratings notes:

- 1 Measured at low line
- 2 Measured at high line

#### Application Notes:

**Agilent 6800 Series  
AC Power Source/Analyzer**  
5963-7044E

**Testing Uninterruptible Power  
Supplies Using Agilent 6800 Series  
AC Power Source/Analyzers,**  
5967-6056E

**Simplify your Avionics Testing with a  
400 Hz Single Phase Power Source that  
includes a Built-in 26 V reference signal**  
5989-3700EN

**Software Driver:**  
*VXIPlug&Play*

**Warranty:** One year

### Supplemental Characteristics

(Continued)

(Non-warranted characteristics determined by design that are useful in applying the product)

Average measurement resolution			
rms voltage	10 mV	10 mV	10 mV
rms current	2 mA	2 mA	2 mA
Programmable output impedance			
resistance	0-1 $\Omega$	0-1 $\Omega$	0-1 $\Omega$
inductance	20 $\mu$ h - 1 mh	20 $\mu$ h - 1 mh	20 $\mu$ h - 1 mh
Remote sense capability			
	Up to 1 Vrms can be dropped across each load lead.	Up to 1 Vrms can be dropped across each load lead.	Up to 1 Vrms can be dropped across each load lead.
Isolation to ground			
	300 Vrms/425 Vdc	300 Vrms/425 Vdc	300 Vrms/425 Vdc
Net weight			
	28.2 kg (62 lb)	28.2 kg (62 lb)	32.7 kg (72 lb)
Shipping weight			
	31.8 kg (70 lb)	31.8 kg (70 lb)	36.4 kg (80 lb)
Dimensions			
	See drawings on page 105		

### AC Input Ratings

Voltage range (Vac) *default factory setting	87 to 106 Vac *104 to 127 Vac 174 to 220 Vac 191 to 254 Vac	87 to 106 Vac *104 to 127 Vac 174 to 220 Vac 191 to 254 Vac	174 to 220 Vac *191 to 254 Vac
Maximum input current (rms) <sup>1</sup>	12 A (100 Vac) 10 A (120 Vac) 7.5 A (200/208 Vac) 6.5 A (230 Vac)	28 A (100 Vac) 24 A (120 Vac) 15 A (200/208 Vac) 13 A (230 Vac)	22 A (200/208 Vac) 20 A (230 Vac)
Input power (max) <sup>2</sup>	1000 VA/700 W	2500 VA/1400 W	3800 VA/2600 W
Input frequency	47 to 63 Hz	47 to 63 Hz	47 to 63 Hz

## AC Power Source/Analyzers: 375-1750 VA (Continued)

### Ordering Information

**Opt 019** 2000 VA AC Power source/ analyzer (6813B only)

**Opt 020** Dual power analyzer option (6813B only)

**Opt 026** 26 Volt, 0.1A auxiliary reference output (6812B only)

**Opt 080** Full documentation on CD-ROM only

**Opt 0L1** Full documentation on CD-ROM, and/with printed standard documentation package

**Opt 0L2** Extra copy of standard printed documentation package

**Opt 1CM** Rack-mount Kit, p/n 5062-3977 (quantity 2) (support rails required)

**Opt 1CP** Rack-mount Kit with Handles, p/n 5062-3983 (support rails required) 6811B, 6812B, 6813B only

*Support rails, p/n 12679B, required when rack mounting the 6811B, 6812B, and 6813B Opt 1CM and Opt 1CP. E3664AC non Agilent rack. E3663AS for Agilent rack.*

**Opt 100** (6811B and 6812B only) 87 to 106 Vac (100 Vac nominal), 47-63 Hz, Japan only

**Opt 120** 104-127 Vac (120 Vac nominal), 47-63 Hz

**Opt 200** (6813B only) 174-220 Vac (200 Vac nominal), 47-63 Hz, Japan only

**Opt 208** (6811B and 6812B only) 174 to 220 Vac (208 Vac nominal), 47-63 Hz

**Opt 230** 191 to 254 Vac (230 Vac nominal), 24-63 Hz

**Opt 831** 12 AWG, 200 to 240 Vac, unterminated (6812B, 6813B only)

**Opt 832** 4 mm<sup>2</sup> wire size, unterminated (6813B only)

**Opt 833** 1.5 mm<sup>2</sup> wire size, 200 to 240 Vac, unterminated (6812B only)

**Opt 834** 10 AWG, 100 to 120 Vac, unterminated (6812B only)

**Opt 841** Line Cord with NEMA L6-20P; 20 A 250 V Plug (6812B only)

**Opt 842** Line Cord with IEC 309; 32 A 220 V plug (6813B only)

**Opt 844** Line Cord with NEMA L6-30P; 30 A 250 V Locking Plug (6813B only)

**Opt 845** Line Cord with IEC 309; 16 A 220 V Plug (6812B only)

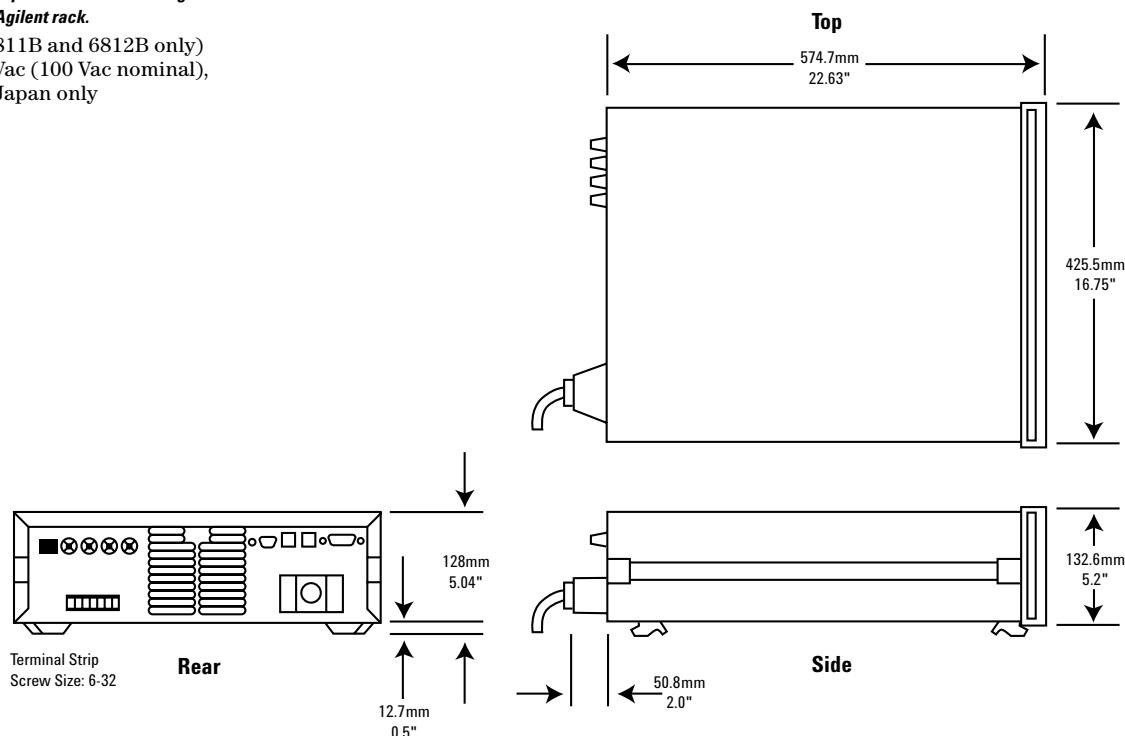
**Opt 846** Line Cord with NEMA L6-30P; 30 A 120 V Plug (6812B only)

**Opt 847** Line Cord with CEE 7/7; 16 A 220 V Plug (6812B only)

**Opt 848** Line Cord with BS 546; 15 A 240 V Plug (6812B only)

**See the AC line voltage and cord section, for more details on line cords.**

### Agilent Models: 6811B, 6812B, 6813B



More detailed specifications at [www.agilent.com/find/6800](http://www.agilent.com/find/6800)

# Choosing AC Line Voltage and Cord Options for your Agilent Power Products

DC Power Supplies, DC Electronic Loads, and AC Sources

## 4 Easy Steps for Choosing Line Cord Options

### Choosing AC Line Voltage and Cord Options for your Power Product

Power distribution systems, regulations, and connection techniques vary greatly among geographic regions as a result of local AC electrical standards. Most Agilent products, including power products which draw less than 500 watts of power from the AC line, can be readily adjusted to accept different line voltages or frequencies.

Line voltage and frequency for certain Power Products may not be field changeable. Choosing the correct voltage option for these products requires care. This is especially true for higher power products.

### Step 1

Go to the tables. Find the model number and the correct line cord option of the product you are ordering.

### Line cords for low power products

### Step 2

If your model # requires a 900 series line cord, the correct one will automatically be shipped for the destination country on the purchase order. DONE!

### Line cords for high power products

### Step 3

If your model number requires an 800 series line cord, determine if there is a line cord with plug that matches your outlet receptacle. If not, choose the appropriate unterminated line cord.

### Step 4

Add the option number for the appropriate line cord to your purchase order. DONE!



## Choosing AC Line Voltage and Cord Options for your Agilent Power Products

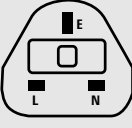
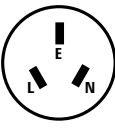
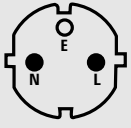

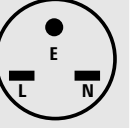
DC Power Supplies, DC Electronic Loads, and AC Sources (Continued)

### Low Power Products

For lower power products, a universal receptacle on the rear panel accepts a wide range of line cords to meet local regulatory requirements. The tables containing the 900 series line cords show a range of standard line cords that Agilent offers, with option numbers and part numbers.

Part numbers are needed to order a line cord separately.

For products which use the 900 series line cords, the appropriate type is automatically selected at time of shipment, based on the country to which the product is being shipped. If you plan to use your power products in a different country or region than the country to which the product is being shipped, you will need to specify the appropriate line voltage and line cord options on your order, so that we can provide the appropriate configuration. Contact your local Agilent Field Engineer for assistance.

Cord Options	900	901	902	903	904
Product/Family					
	United Kingdom	Australia New Zealand	Europe	United States Canada	United States Canada
<b>6033A, 38A</b>	8120-1351	8120-1369	8120-1689	8120-4383	8120-0698
<b>6060B, 63B</b>	8120-1351	8120-1369	8120-1689	8120-4383	8120-0698
<b>6541A - 45A</b>	8120-1351	8120-1369	8120-1689	8120-4383	8120-0698
<b>6551A - 55A</b>	8120-1351	8120-5412	8120-5413	8120-5337	8120-5421
<b>6611C - 14C</b>	8120-8705	8120-1369	8120-1689	8120-4383	8120-0698
<b>6621A - 6629A</b>	8120-1351	8120-1369	8120-1689	8120-4383	8120-0698
<b>6631B - 34B</b>	8120-8705	8120-1369	8120-1689	8120-4383	8120-0698
<b>6641A - 45A</b>	8120-1351	8120-1369	8120-1689	8120-4383	8120-0698
<b>6651A - 55A</b>	8120-1351	8120-5412	8120-5413	8120-5337	8120-5421
<b>6811B</b>	8120-1351	8120-5412	8120-1689	8120-5337	8120-5421
<b>66309B/D</b>	8120-8705	8120-1369	8120-1689	8120-4383	8120-0698
<b>66311B/D</b>	8120-8705	8120-1369	8120-1689	8120-4383	8120-0698
<b>66319B/D</b>	8120-8705	8120-1369	8120-1689	8120-4383	8120-0698
<b>66321B/D</b>	8120-8705	8120-1369	8120-1689	8120-4383	8120-0698
<b>66332A</b>	8120-8705	8120-1369	8120-1689	8120-4383	8120-0698
<b>E3610 - 17A</b>	8120-1351	8120-1369	8120-8768	8120-8767	8120-0698
<b>E3620A</b>	8120-1351	8120-1369	8120-8768	8120-8767	8120-0698
<b>E3630A</b>	8120-1351	8120-1369	8120-8768	8120-8767	8120-0698
<b>E3631 - 34A</b>	8120-1351	8120-1369	8120-8768	8120-8767	8120-0698
<b>E3640 - 49A</b>	8120-1351	8120-1369	8120-8768	8120-8767	8120-0698
<b>E4350B, 51B</b>	8120-1351	8120-5412	8120-5413	8120-5337	8120-5421
<b>N5741A - 52A</b>	8120-1351	N/A	8120-1689	8120-4383	N/A
<b>N6700B</b>	8120-1351	8120-1369	8120-1689	8120-4383	8120-0698
<b>N3280A</b>	8120-8705	8120-1369	8120-1689	8120-4383	8120-0698
<b>N3300A, 31A</b>	8120-1351	8120-1369	8120-1689	8120-4383	8120-0698

L = Line or Active Conductor (also called "live" or "hot")

N = Neutral or identified Conductor

E = Earth or Safety Ground

For more detailed specifications see the product manual at [www.agilent.com/find/power](http://www.agilent.com/find/power)

## Choosing AC Line Voltage and Cord Options for your Agilent Power Products

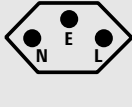
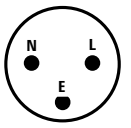



DC Power Supplies, DC Electronic Loads, and AC Sources (Continued)

### High Power Products

There are several factors which limit the amount of power which can be readily drawn from a normal branch circuit. For example, in the U.S., the typical 115/120 Vac branch circuit has a circuit breaker rated for 15 A. For industrial applications, 20 A service is commonly available.

Linear power supplies with outputs over 500 watts and switching supplies rated over 750 watts will generally exceed the capability of a 15 A branch circuit. Connecting power products above these power levels will require installing either a higher voltage or higher current service. Some practical examples are:

- standard line voltage for 2KW products such as the 667XA is 230 Vac; they can not be powered off a 120 Vac line
- the 1KW 601XA and 603XA products cannot be powered off a standard 15 A/120 Vac circuit; they can operate off a 30 A/120 Vac service, or they can be configured for 208/240 Vac operation

Cord Options	906	912	917	918	919
Product/Family	 Switzerland	 Denmark	 South Africa India	 Japan	 Israel
6033A, 38A	8120-2104	8120-2956	8120-4211	8120-4753	8120-6800
6060B, 63B	8120-2104	8120-2956	8120-4211	8120-4753	8120-6800
6541A - 45A	8120-2104	8120-2956	8120-4211	8120-4753	8120-6800
6551A - 55A	8120-2104	8120-2956	8120-5414	8120-5342	8120-6800
6611C - 14C	8120-2104	8120-2956	8120-4211	8120-4753	8120-6800
6621A - 6629A	8120-2104	8120-2956	8120-4211	8120-4753	8120-6800
6631B - 34B	8120-2104	8120-2956	8120-4211	8120-4753	8120-6800
6641A - 45A	8120-2104	8120-2956	8120-4211	8120-4753	8120-6800
6651A - 55A	8120-2104	8120-2956	8120-5414	8120-5342	8120-6800
6811B	8120-2104	8120-2956	8120-5414	8120-5342	8120-6800
66309B/D	8120-2104	8120-2956	8120-4211	8120-4753	8120-6800
66311B/D	8120-2104	8120-2956	8120-4211	8120-4753	8120-6800
66319B/D	8120-2104	8120-2956	8120-4211	8120-4753	8120-6800
66321B/D	8120-2104	8120-2956	8120-4211	8120-4753	8120-6800
66332A	8120-2104	8120-2956	8120-4211	8120-4753	8120-6800
E3610 - 17A	8120-2104	8120-2956	8120-4211	8120-4753	8120-5181
E3620A	8120-2104	8120-2956	8120-4211	8120-4753	8120-5181
E3630A	8120-2104	8120-2956	8120-4211	8120-4753	8120-5181
E3631 - 34A	8120-2104	8120-2956	8120-4211	8120-4753	8120-5181
E3640 - 49A	8120-2104	8120-2956	8120-4211	8120-4753	8120-5181
E4350B, 51B	8120-2104	8120-2956	8120-5414	8120-5342	8120-6800
N5741A - 52A	N/A	N/A	N/A	8120-4753	N/A
N6700B	8120-2104	8120-2956	8120-4211	8120-4753	8120-6800
N3280A	8120-2104	8120-2956	8120-4211	8120-4753	8120-6800
N3300A, 31A	8120-2104	8120-2956	8120-4211	8120-4753	8120-6800

L = Line or Active Conductor (also called "live" or "hot")

N = Neutral or identified Conductor

E = Earth or Safety Ground


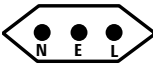


For more detailed specifications see the product manual at [www.agilent.com/find/power](http://www.agilent.com/find/power)

## Choosing AC Line Voltage and Cord Options for your Agilent Power Products

### DC Power Supplies, DC Electronic Loads, and AC Sources (Continued)

Agilent offers a range of 800 series line cords for many higher power products to mate with the wall receptacles commonly specified for these higher power services. Refer to the tables to determine if there is a 800 series line cord for your product with a plug that meets the local requirements. If not, you must order an unterminated line cord.

Often, higher power products (over 1 kW) are hardwired, i.e. connected directly to a breaker panel or distribution box. The line cord may also be hard wired to the back of the power supply where a universal receptacle is impractical. Typically, a local electrician should be consulted to determine the best alternative to connect a high power product to the AC line.

Cord Options	920	921	922	927
Product/Family	 Argentina	 Chile	 China	 Brazil Thailand
6033A, 38A	8120-6869	8120-6980	8120-8376	8120-8871
6060B, 63B	8120-6869	8120-6980	8120-8376	8120-8871
6541A - 45A	8120-6869	8120-6980	8120-8376	8120-8871
6551A - 55A	8120-6869	8120-6980	8120-8376	8120-8871
6611C - 14C	8120-6869	8120-6980	8120-8376	8120-8871
6621A - 6629A	8120-6869	8120-6980	8120-8376	8120-8871
6631B - 34B	8120-6869	8120-6980	8120-8376	8120-8871
6641A - 45A	8120-6869	8120-6980	8120-8376	8120-8871
6651A - 55A	8120-6869	8120-6980	8120-8376	8120-8871
6811B	8120-6869	8120-6980	8120-8376	8120-8871
66309B/D	8120-6869	8120-6980	8120-8376	8120-8871
66311B/D	8120-6869	8120-6980	8120-8376	8120-8871
66319B/D	8120-6869	8120-6980	8120-8376	8120-8871
66321B/D	8120-6869	8120-6980	8120-8376	8120-8871
66332A	8120-6869	8120-6980	8120-8376	8120-8871
E3610 - 17A	8120-6869	8120-6980	8120-8376	8120-8871
E3620A	8120-6869	8120-6980	8120-8376	8120-8871
E3630A	8120-6869	8120-6980	8120-8376	8120-8871
E3631 - 34A	8120-6869	8120-6980	8120-8376	8120-8871
E3640 - 49A	8120-6869	8120-6980	8120-8376	8120-8871
E4350B, 51B	8120-6869	8120-6980	8120-8376	8120-8871
N5741A - 52A	N/A	N/A	8120-8376	N/A
N6700B	8120-6869	8120-6980	8120-8376	8120-8871
N3280A	8120-6869	8120-6980	8120-8376	8120-8871
N3300A, 31A	8120-6869	8120-6980	8120-8376	8120-8871

L = Line or Active Conductor (also called "live" or "hot")

N = Neutral or identified Conductor

E = Earth or Safety Ground

For more detailed specifications see the product manual at [www.agilent.com/find/power](http://www.agilent.com/find/power)

## Choosing AC Line Voltage and Cord Options for your Agilent Power Products


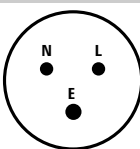
DC Power Supplies, DC Electronic Loads, and AC Sources (Continued)

### Products with 3-Phase Inputs

Some of the higher power products exceed the capability of a single phase line. Agilent offers several power products which require 3-phase inputs, including the 5 kW 668XA and 6.6 kW 669XA DC source family. For 3-phase power distribution up to the building, there are two different distribution systems in wide use: delta, predominantly used in the US; and wye predominantly used in Europe. However, for service inside the building, the 5 wire wye is the predominant configuration. Products which are delta loads, are compatible with either delta or wye. Agilent 3-phase products are delta loads.

In selecting the correct operating voltage for 3-phase products you need to distinguish between the line-to-line and the line-to-neutral voltages. The line-to-line voltage is the square root of 3 x the line-to-neutral voltage. It is the line-to-line voltage that is used to specify the input voltage to be applied to Agilent power products.

Cord Options	831	832	833	834
Product/Family	No Plug #12AWG	No Plug 4 mm <sup>2</sup>	No Plug 1.5mm <sup>2</sup>	No Plug #10AWG
6010A, 11A, 12B, 15A	8120-5573	N/A	8120-5568	8120-5566
6030A, 31A, 32A, 35A	8120-5573	N/A	8120-5568	8120-5566
6571A - 75A	8120-5488	8120-5490	N/A	8120-5545
6671A - 75A	8120-5488	8120-5490	N/A	8120-5545
6812B	8120-5573	N/A	8120-5568	8120-5566
6813B	8120-5573	8120-6502	N/A	8120-5566
66000A	8120-5573	N/A	8120-5568	8120-5566
E4356A	8120-5488	8120-5490	N/A	8120-5545

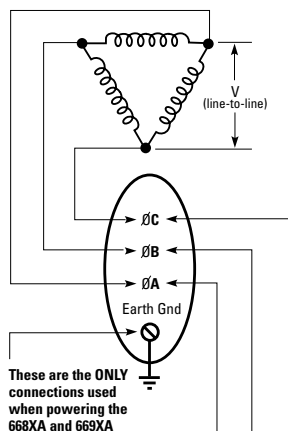
Cord Options	861	862	841	842
Product/Family	No Plug (AWG) N/S America, other Harmonized (AWG wire)	No Plug (Metric) UK non-Europe other Harmonized (metric wire)	 NEMA 6-20P #12AWG N/S America Japan	 IEC 309 32-A 4mm <sup>2</sup> Europe
6010A, 11A, 12B, 15A	N/A	N/A	8120-5572	N/A
6030A, 31A, 32A, 35A	N/A	N/A	8120-5572	N/A
6571A - 75A	N/A	N/A	8120-5491	8120-5489
6671A - 75A	N/A	N/A	8120-5491	8120-5489
6680A - 84A	8121-6203	8120-6204	N/A	N/A
6690A - 92A	8121-0694	8121-0695	N/A	N/A
6812B	N/A	N/A	8120-5572	N/A
6813B	N/A	N/A	8120-5572	8120-6506
66000A	N/A	N/A	8120-5572	N/A
E4356A	N/A	N/A	8120-5491	8120-5489
N5761A-72A	8121-1330	8121-1331	N/A	N/A

For more detailed specifications see the product manual at [www.agilent.com/find/power](http://www.agilent.com/find/power)

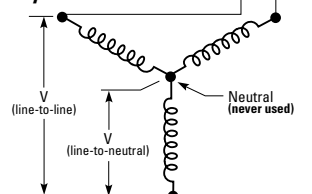
## Choosing AC Line Voltage and Cord Options for your Agilent Power Products

### DC Power Supplies, DC Electronic Loads, and AC Sources (Continued)

#### Delta


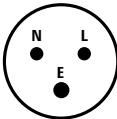

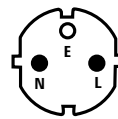
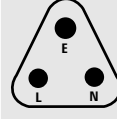


#### Wye



#### In a wye system

$$V_{(\text{line-to-neutral})} = \frac{V_{(\text{line-to-line})}}{\sqrt{3}}$$

Cord Options	844	845	846	847	848
Product/Family					
	<b>NEMA L6-30P</b> #10AWG N/S America	<b>IEC 309 16-A</b> 1.5 mm <sup>2</sup> Denmark Switzerland Austria, China	<b>NEMA L5-30P</b> #10AWG N. America	<b>CEE 7/7 16-A</b> 1.5 mm <sup>2</sup> Europe	<b>BS 546 15-A</b> 1.5 mm <sup>2</sup> India South Africa
<b>6010A, 11A, 12B, 15A</b>	N/A	8120-5570	8120-5565	8120-5567	8120-5569
<b>6030A, 31A, 32A, 35A</b>	N/A	8120-5570	8120-5565	8120-5567	8120-5569
<b>6571A - 75A</b>	8120-5546	N/A	N/A	N/A	N/A
<b>6671A - 75A</b>	8120-5546	N/A	N/A	N/A	N/A
<b>6680A - 84A</b>	8121-6203	8120-6204	N/A	N/A	N/A
<b>6812B</b>	N/A	8120-5570	8120-5565	8120-5567	8120-5569
<b>6813B</b>	8120-6507	N/A	N/A	N/A	N/A
<b>66000A</b>	N/A	8120-5570	8120-5565	8120-5567	8120-5569
<b>E4356A</b>	8120-5546	N/A	N/A	N/A	N/A

# Power Products

## Applications Information

### 10 Most frequently asked questions about using DC power products

10 Most frequently asked questions about using DC power products  
AC Power and Load Connections  
Power Products Terms

1

#### How do I put the power supply in the constant current mode?

The power supply cannot be “put” into the constant current mode. The output settings of the power supply combined with the ohmic value of the particular load determine whether or not the power supply is in constant current.

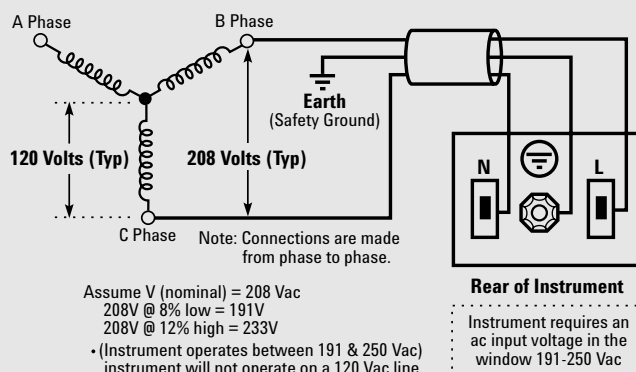
**ie:** The power supply inherently resides in the constant voltage mode. If the output voltage were set to 24 volts and a  $6\ \Omega$  load were placed across the output terminals, Ohm’s Law would require that 4 amps would flow ( $24\text{ V}/6\ \Omega$ ). This presumes that the constant current setting of the power supply were set to a value greater than 4 amps; lets say 5 amps. Now, if the  $6\ \Omega$  load were replaced by a  $2\ \Omega$  load, Ohm’s Law would suggest that 12 amps ( $24\text{ V}/2\ \Omega$ ) would flow. However, the power supply is set to go into constant current at 5 amps. Therefore, the actual output voltage would be 10 volts ( $2\ \Omega \times 5\text{ A}$ ). The power supply will now remain in constant current for values of load  $= 0\ \Omega \leq R < 4.8\ \Omega$ . Once the ohmic value of the load becomes greater than  $4.8\ \Omega$  ( $24\text{ V}/5\text{ A}$ ), the power supply will again revert to constant voltage operation at the value of 24 volts.

2

#### I have 208 vac, 3 $\phi$ phase power; can it be used to operate a product requiring 208 V single phase?

Yes, see below.

##### 657xA/667xA Connection to a 3-phase line



3

#### Why are the required Watts and VA so different?

Watts is a scalar quantity which is frequently used to measure system efficiency. It is the energy supplied by the utility company over a given period of time and is commonly referred to as power. Except for heavy industrial users, the utility company only bills users for the watts consumed. Watts are directly convertible into mechanical work or

BTUs (British Thermal Units) of heat. Wasted power is paid for a second time in terms of additional loading on the user’s air-conditioning system. Mathematically, it is a scalar quantity resulting from the vector product of two vector quantities (volts and amps). It is NOT the simple algebraic product of the rms volts times rms current.

VA on the other hand IS the scalar quantity resulting from multiplying the magnitudes (rms) of the vector

More detailed specifications at [www.agilent.com/find/power](http://www.agilent.com/find/power)

quantities (volts and amps). This resulting quantity will never be smaller than the watts demanded by an instrument. Uninformed users incorrectly use VA to assess the device's over-all efficiency and power demands. VA is most frequently and correctly used by electricians to determine proper AC mains conductor gage and circuit breaker sizing.

### 4

#### How much cooling do I need for my power supply?

Users frequently rack power supplies into an enclosure to supply power to some remotely located external load. Under these conditions, to properly determine the cooling requirements, the systems integrator needs thermal data from the manufacturer for the specific enclosure in question. This data is generally in the form of a curve which relates the rise of the enclosure's internal air temperature to the amount of power (or BTU's) dissipated within the enclosure.

The difference between the maximum power demanded by the external load, and the AC power demanded by the power supply to support the load's needs, is the power dumped into the internal air of the enclosure. Using this number and data for the enclosure, the internal rise can be determined. The internal rise added to the external ambient temperature will determine the temperature of the environment for the power supply. This must be within the ratings of the product or premature failure will occur.

A valuable conversion factor between Watts and BTU's is listed below:

$$1 \text{ BTU/Hr} = 0.293 \text{ Watt}$$

### 5

#### Can Agilent power supplies sink current?

Yes! Sinking, or downprogramming, is the ability of a power supply to pull current into the positive power terminal. Sinking is necessary to discharge the power supply's own output capacitor, or the capacitors that are part of an external load.

Sinking is particularly important, for example, in printed circuit board test systems. The relays in test board systems typically must be switched only when the power supplies have discharged to zero volts, to avoid arcing and burn-out of the relay contacts. Sinking allows the power supply outputs to go to zero quickly, thus providing faster test times, an important factor for reducing overall test cost.

The value of the sink current is fixed and is not programmable, with the exception of the 6630 series, where sink current is set to the same value that is programmed for source current.

In general, sinking is provided to improve a power supply's transition time from a higher to a lower constant voltage operating level, and is not intended to be a steady-state operating condition.

Series	Current Sinking Capability
6620 Multiple Output	110% of source current rating
6620 Precision Output	110% of source current rating

Series	Current Sinking Capability
6630 100 Watt	110% of source current rating
6030 Autorangers	50 W/actual output voltage in volts or actual output voltage volts/0.05 ohms, whichever is less
6640 200 Watt	25% of source current rating
6650 500 Watt	20% of source current rating
6670 2000 Watt	50 W/actual output voltage in volts or actual output voltage in volts/0.05 ohms, whichever is less
6680 5000 Watt	50 W/actual output voltage in volts or actual output voltage in volts/0.05 ohms, whichever is less
6690 6600 Watt	50 W/actual output voltage in volts or actual output voltage in volts/0.05 ohms, whichever is less

### 6

#### I want to put a microswitch on the safety cover over my UUT so that lifting the cover will program my ATE power supplies to zero volts and protect the operator from harm. Do Agilent power supplies have this capability?

Yes, all of the GPIB programmable supplies in the 6030, 6640, 6650, 6670 and 6680 series have this capability built-in at no extra cost. It's called "Remote Inhibit" (RI). RI is available as an option at extra cost on the 6620 and 6630 series. A contact closure or TTL low signal programs the output of the supply to zero volts. The power supply can also be programmed to generate a service request (SRQ) via the GPIB in the event that RI is pulled low.

**7**

**Can I use Agilent Electronic Loads in series and in parallel?**

Agilent electronic loads are designed to be operated in parallel for more current, but NOT in series for more

voltage. Loads are fully protected against damage from current overloads, but will be damaged by voltage above the maximum voltage rating.

**8**

**I must test a 1 volt power supply using a constant current load and I want to use Agilent Electronic Loads. But the Agilent load meets all of its dynamic specs with**

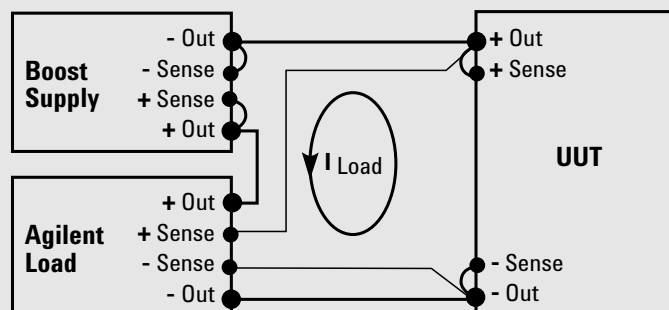
Use a boost supply in series with the UUT. The load will now meet all its specs with no derating, because it always operates above 3 volts. (see the illustration below)

The boost supply can be a low-cost fixed output 3 V or 5 V supply with a current rating at least as high as the maximum peak load current needed. The 6641A (8 V, 20 A), 6651A (8 V, 50 A), 6671A (8 V, 220 A), or 6681A (8 V, 580 A) are all excellent choices.

**no derating on down to 3 volts. Below 2 volts, the Agilent load current must be linearly derated. What can I do?**

The voltage setting of a programmable boost supply should be set to 3 volts, and the current limit set to full scale.

Select a boost power supply with low p-p ripple and noise. The constant current load will compensate for low-frequency p-p ripple and noise below a few kHz, but high frequency ripple and noise from the boost will appear across the UUT.



**9**

**Why are Agilent's Electronic Loads constant resistance resolution specified in ohms on the low resistance range, but in mSiemens on the two higher ranges?**

In general, Agilent's Electronic Loads are not a conventional "resistor". The loads consist of IC's, capacitors, resistors, FETs, etc. They were designed with two major circuits, a cv and cc circuit. These circuits are used to simulate resistance on the two upper ranges.

First, it is necessary to understand why there is a difference in the way in which the ranges are specified (mohms or mS). The constant resistance (CR) mode in the load actually operates using either the constant current (CC) or constant voltage (CV) circuits inside the load. The lowest CR range uses the CV regulating circuits, while the two higher ranges use the CC regulating circuits. It is because of these differences in the circuits used to regulate the load input that the specifications need to be different.

When the CV circuits are used, the load can be viewed as many resistors, all the same value (the resolution), in series to produce the desired resistance. Then, changing the resistance is like changing the number of discrete resistors in series. Therefore, the resolution is the value of one of these series resistors, and putting resistors in series changes the resistance measured in ohms. For the N3302A, the "discrete resistor" or resolution that can be programmed is 0.54 mohms in the 2 ohm range.



When the CC circuits are used, the load can be viewed as many resistors, all the same value (the resolution), in parallel to produce the desired resistance. Then, changing the resistance is like changing the number of discrete resistors in parallel. Therefore, the resolution is the value of one of these parallel resistors, and putting resistors in parallel changes the conductance measured in siemens. For the 60501B, the “discrete resistor” or resolution that can be programmed is 0.14 mS (=7.14 kohms).

For example, in the 2 kohm range, you can program the load input from 2 ohms to 2 kohms (0.5 S to 0.5 mS) with a resolution of 0.14 mS. This would be the equivalent of starting with about 3568 7.143 kohm resistors in parallel with each other, and in parallel with a 2 kohm resistor, and removing one at a time until you had only the 2 kohm resistor left.

Note that the resolution of the conductance is constant at 0.14 mS, however, the resolution of the total parallel resistance is not constant. It depends on how many resistors you have in parallel.

If you have two 7.143 kohm resistors in parallel and remove one, the resolution looks like 3571.5 ohms. If you have 3568 7.143 kohm resistors in parallel and remove one, the resolution looks like  $(7143/3567) - (7143/3568) = 0.561$  mohms. But the conductance resolution is constant at 0.14 mS.

## 10

### **Can Agilent power supplies be programmed from 0 to full output voltage using a 0 to 10 V signal source?**

Yes, many Agilent power supplies feature remote voltage programming or analog programming capability. However, there is a potential danger in analog programming any power supply, especially a high voltage supply. If the 0 to 10 V programming source is a typical, non-isolated, low-cost, digital-to-analog converter (DAC), it is probably grounded through its digital inputs and/or through the computer’s internal power supplies, which are grounded through the computer’s power cord. It’s easy to overlook this, and the mistake can be very expensive.

If the DAC is non-isolated (or isolated only up to 42 V above ground) and one of the output terminals of the power supply is grounded, either directly or through the UUT, the output capacitor of the power supply can discharge through the computer backplane, motherboard, and the I/O common through the computer power cord ground. The resulting high current may even last long enough to vaporize the thin ground tracks on some or all of the printed circuit boards in the PC.

Be sure the programming source is electrically isolated, is operated from isolated power supplies, and is rated for floating voltages up to the full output voltage of the programmed supply. This is necessary so no one is hurt, and no equipment is damaged, no matter which output terminal of the power supply or UUT is grounded.

For additional questions and answers visit our web site at [www.agilent.com/find/answers](http://www.agilent.com/find/answers)

A modern stabilized DC power supply is a versatile high performance instrument capable of delivering a constant or controlled output reliably and with little attention. But to take full advantage of the performance characteristics designed into a supply, certain basic precautions must be observed when connecting it for use on the lab bench or installing it in a system. Factors such as wire ratings, system grounding techniques, and the particular way that AC input, DC output, and remote error sensing connections are made can contribute materially to obtaining the stable, low noise output expected by the user. Careful attention to the following guidelines can help to ensure the trouble free operation of your Agilent power supply.

### AC Power Input Connections

#### Wire Rating

**RULE 1. When connecting AC power to a power supply, always use a wire size rated to carry at least the maximum power supply input current.**

If a long cable is involved, make an additional check to determine whether a still larger wire size might be required to retain a sufficiently low impedance from the service outlet to the power supply input terminals. As a general guideline, input cables should be of sufficient size to ensure that the voltage drop at maximum rated power supply input current will not exceed 1% of the nominal line voltage.

#### Continuity

**RULE 2. Maintain the continuity of the AC, acc, and grounding wires from the AC power outlet to the power supply input terminals without an accidental interchange.**

Interchanging the AC and grounding wires may result in the power supply chassis being elevated to an AC potential equal to the input line voltage. If the chassis is grounded elsewhere, the result may be no worse than some blown fuses. But if the chassis is not grounded, the result could be a potentially lethal shock hazard. Confirm that the chassis is grounded by the grounding wire.

#### Transformers

**RULE 3. If an autotransformer or an isolation transformer is connected between the AC power source and the power supply input terminals, it should be rated for at least 200% of the maximum rms current required by the power supply.**

The transformer must have a higher rating than would be suggested by the supply's rms input current because a power supply input circuit does not draw current continuously. Input current peaks can cause a smaller transformer to saturate, resulting in failure of the supply to meet its specifications at full output.

**RULE 4. Be sure to connect the common terminal of an autotransformer to the acc (and not the AC) terminals of both the power supply and the input power line.**

If acc is not connected to the common terminal of the autotransformer, the power supply's input acc terminal will have a higher than normal AC voltage connected to it, contributing to a shock hazard and, in some instances, a greater output ripple.

#### AC Line Regulator

**RULE 5. Do not use an AC line regulator at the input to a regulated power supply without first checking with the power supply manufacturer.**

Some regulators tend to increase the impedance of the line in a resonant fashion and can cause power supplies to malfunction, particularly if they use SCR or switching regulators or preregulators. Moreover, since the control action of many line voltage regulators is accompanied by a change in the output waveshape, their advantage in providing a constant rms input to a power supply is small. In fact these changes in waveshape are often just as disruptive in causing power supply output changes as the original line voltage amplitude changes would have been.

### Load and Remote Error Sensing Connections

#### Making Load Connections to One Power Supply

The simplest and most common example of improper load wiring is shown in Figure 1. The voltage at each load depends on the current drawn by the other loads and the voltage drops they cause in some portion of the load leads. Since most load currents vary with time, an interaction among the loads results. This interaction can sometimes be ignored, but in most applications the resulting noise, pulse coupling, or tendency toward inter-load oscillation is unacceptable. The following thirteen steps describe a recommended procedure for connecting the load wiring, grounding the system in a manner that avoids troublesome ground loops, and making connections for remote error sensing.

**STEP 1. Select a load wire size that, as an absolute minimum, is heavy enough to carry the power supply output current that would flow if the load terminals were short-circuited.**

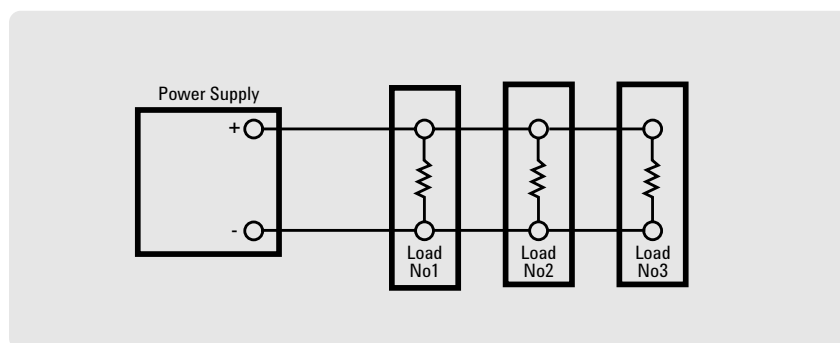
This is the minimum, however. Impedance and coupling considerations usually dictate the use of load wires larger than would be required just to satisfy current rating requirements. In general, the power supply performance degradation seen at the load terminals becomes significant when the wire size and length result in a load wire impedance comparable to or greater than the effective output impedance of the power supply. Refer to a copper wire resistance table to see if a larger wire size might have to be used to attain an impedance comparable to or smaller than the output impedance of the power supply.

If multiple loads are supplied from a pair of DC distribution terminals not located at the power supply terminals, it is necessary to consider separately the mutual impedance of the wires connecting the power supply to the distribution terminals and the additional impedance of the wires to each individual load. The mutual impedance presents an opportunity for a variation of one load current to cause a DC voltage variation at another load. Fortunately this mutual impedance can be effectively reduced at DC and at low frequencies by using remote error sensing, as will be described later.

#### Connect the Load Wiring

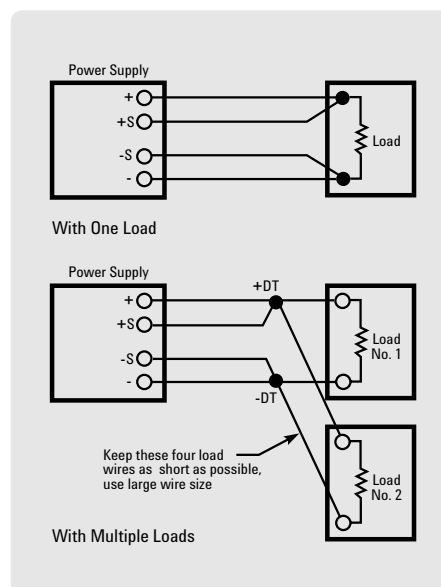
**STEP 2. Designate a single pair of terminals as the positive and negative DC distribution terminals.**

These two terminals might be the power supply output terminals, the load terminals, or a separate pair of terminals established expressly for distribution. If the power supply is a short distance from the load and remote sensing will not be used, locate the DC distribution terminals as near as possible to the power supply output terminals. Using the power supply output terminals themselves as the distribution terminals results in optimum performance.



**Figure 1**  
Improper load connections

If remote sensing is to be used, locate the DC distribution terminals as near as possible to the load terminals. Later in the procedure, sensing leads will be connected from the power supply sensing terminals to the DC distribution terminals as shown in Fig. 2.



**Figure 2**  
Location of DC Distribution Terminals with Remote Sensing (Distribution Terminals are Shown Solid)

**STEP 3. Connect one pair of wires directly from the power supply output terminals to the DC distribution terminals, and connect a separate pair of wires from the distribution terminals to each load.**

There should be no direct connection from one load to another except by way of the DC distribution terminals. (Although for clarity the diagrams show the load and sensing leads as straight lines, some immunity against pick-up from stray magnetic fields can be obtained by twisting each pair of load leads and shielding all sensing leads.)

### Decouple Multiple Loads

**STEP 4. If required, connect a local decoupling capacitor across each pair of distribution and load terminals.**

Load decoupling capacitors are often needed when multiple loads draw pulse currents with short rise times. To reduce high frequency mutual coupling effects under these circumstances, capacitors must be connected directly across the load and distribution terminals. The capacitors used for decoupling must be selected to have a high frequency impedance that is lower than the impedance of the wires connected to the same load, and their connecting leads must be kept as short as possible to minimize impedance.

### Grounding the System

Since no two ground points have exactly the same potential, the idealized concept of a single ground potential is a snare and a delusion. In many cases the potential difference is small, but a difference in two ground potentials of even a fraction of a volt could cause amperes of current to flow through a complete ground loop. (Ground loop is a term used to describe any conducting path formed by two separate connections to ground). Ground loops can cause serious interference problems when voltages developed by these currents are coupled into sensitive signal circuits.

To avoid ground loop problems, there must be only one ground return point in a power supply system. (A power supply system includes the power supply, all of its loads, and all other power supplies connected to the same loads). The selection of the best ground return point depends on the nature and complexity of the DC wiring. In large systems, practical problems frequently tend to force compromises with the ideal grounding concept. For example, a rack mounted system consisting of separately mounted power supplies and loads generally has multiple ground connections. Each instrument usually has its own chassis tied to the third grounding wire of its power cord, and the rack is often connected by a separate wire

to ground. With the instrument panels fastened to the rack frame, circulating ground currents are inevitable. However, as long as these ground currents are confined to the ground system and do not flow through any portion of the power supply DC distribution wiring, their effect on system performance is usually negligible. To repeat, separating the DC distribution circuits from any conductive paths in common with ground currents

will in general reduce or eliminate ground loop problems. The only way to avoid such common paths is to connect the DC distribution system to ground with only one wire. Figure 3 illustrates this concept: DC and signal currents circulate within the DC system, while ground loop currents circulate within the ground system. Steps, 5, 6, and 7 make specific recommendations for avoiding ground loop problems.

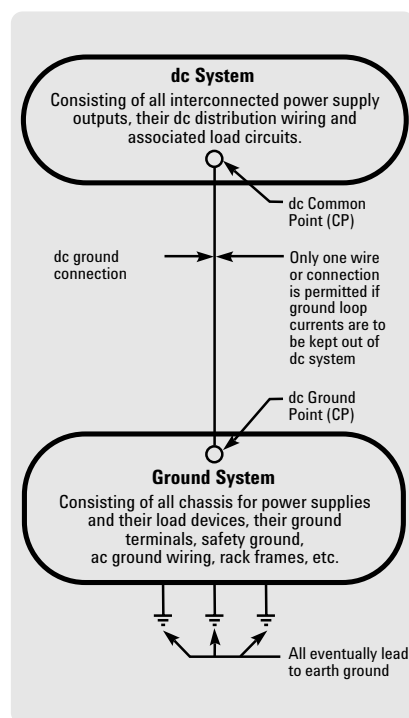
### Select the DC Common Point

#### STEP 5. Designate one of the DC distribution terminals as the DC common point.

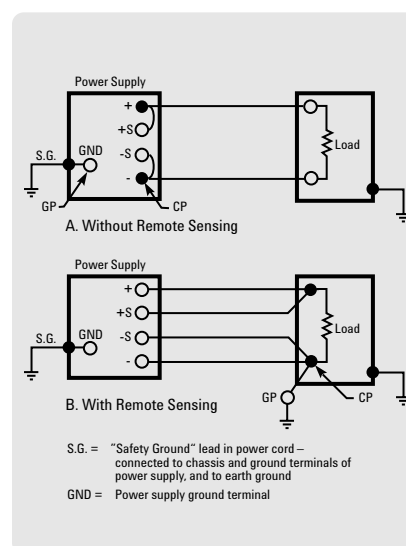
There should be only one DC common point in a DC system. If the supply is to be used as a positive source, then the negative DC distribution terminal is the DC common point. If it is to be a negative source, then the positive DC distribution terminal is the DC common point. Here are some additional suggestions for selecting the best DC common point for five different classes of loads:

#### a. Single Isolated Load.

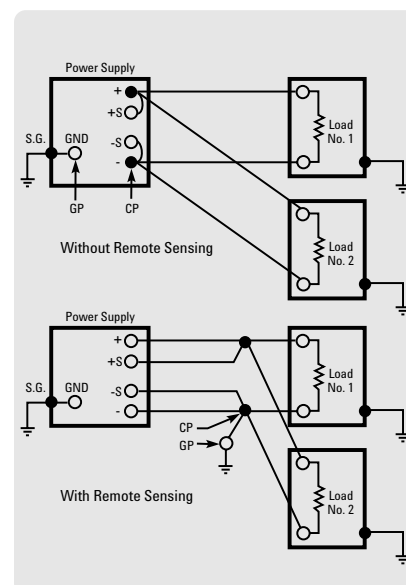
A single isolated load exists when a power supply is connected to only one load and the load circuit has no internal connections to the chassis or ground. If the power supply output terminals are to be used as the DC distribution terminals, then the DC common point will be either the positive or negative power supply output terminal (Fig. 4A). If remote sensing is to be used and the load terminals will serve as the distribution terminals, then either the positive or negative load terminal will be the DC common point (Fig. 4B).



**Figure 3**  
Isolating Ground Loop Paths from the DC system



**Figure 4**  
Preferred Ground Connections for a Single Isolated Load



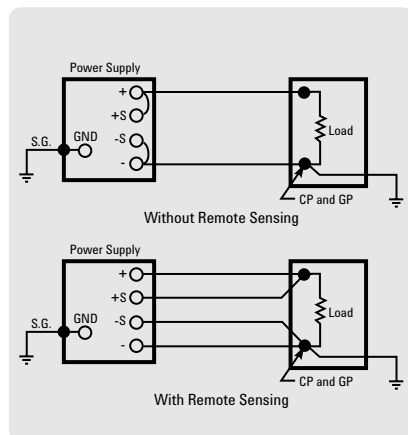
**Figure 5**  
Preferred Ground Connections for Multiple Ungrounded Loads

**b. Multiple Ungrounded Loads.**

This alternative applies when separate pairs of load leads connect two or more loads and none of the load circuits has an internal connection to chassis or ground (Fig. 5). Use the positive or negative DC distribution terminal as the DC common point.

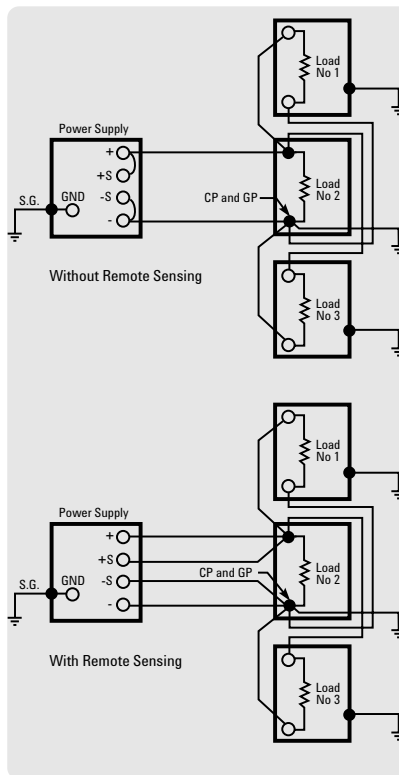
**c. Single Grounded Load.**

When a power supply is connected to a single load that has a necessary internal connection to chassis or ground as in Fig. 6, or when a supply is connected to multiple loads only one of which has a necessary internal connection to chassis or ground as in Fig. 7, the load terminals of the grounded load must be designated the DC distribution terminals, and the grounded load terminal is necessarily the DC common point.



**Figure 6**

Preferred Ground Connections for a Single Grounded Load



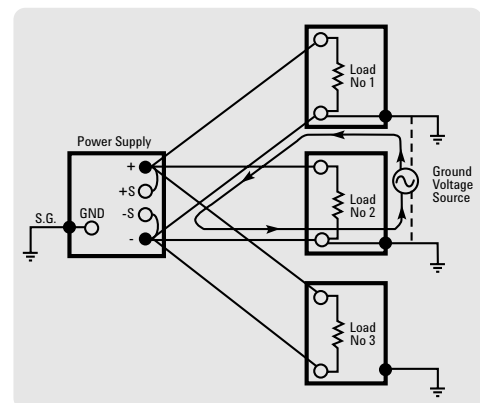
**Figure 7**

Preferred Ground Connections for Multiple Loads, Only One of Which is Grounded Internally

**d. Multiple Loads, Two or More of Which are Individually Grounded.**

This undesirable situation must be eliminated if at all possible. Ground loop currents circulating through the DC and load wiring cannot be avoided so long as separate loads connected to the same power supply or DC system have separate ground returns as shown in Fig. 8.

One possible solution is to break the ground connection in all of the loads and then select the DC common point using the multiple ungrounded load alternative as in (b) above. Another would be to break the ground connection in all but one of the loads and select the DC common point as in alternative (c). If there are two or more loads with ground connections that cannot be removed and the system is susceptible to ground loop problems, then the only satisfactory solution is to increase the number of power supplies and to operate each grounded load from a separate supply. Each combination of power supply and grounded load would be treated as in alternative (c).

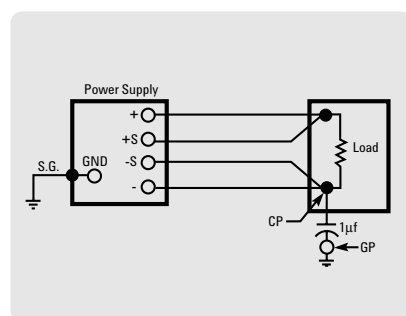


**Figure 8**

Improperly Connected DC Distribution System with Two Grounded Loads forming a Ground Loop

## e. Load System Floated at a DC Potential Above Ground.

It is sometimes necessary to operate the power supply output at a fixed voltage above or below ground potential. The usual procedure in these circumstances is to designate a DC common point using whichever of the preceding four alternatives is appropriate, just as though conductive grounding were to be used. Then connect this DC common point to the DC ground point through a 1 microfarad capacitor as shown in Figure 9.



**Figure 9**  
Floating a Load System at a DC Potential Above Ground

## Select the DC Ground Point

**STEP 6. Designate the terminal that is connected to ground as the DC ground point.**

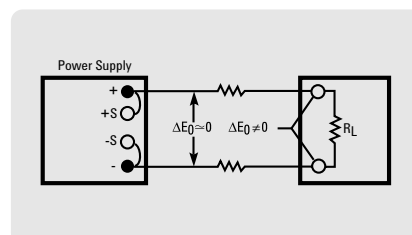
The DC ground point can be any single terminal, existing or added, that is conductively connected to the ground of the building wiring system and then eventually to earth ground.

**STEP 7. Connect the DC common point to the DC ground point, making certain there is only one conductive path between these two points.**

Make this connection as shown in Figures 4, 5, 6, or 7. Make the connection as short as possible and use a wire size such that the total impedance from the DC common point to the DC ground point is not large compared with the impedance from the ground point to earth ground. Flat braided leads are sometimes used to further reduce the high frequency component of the ground lead impedance.

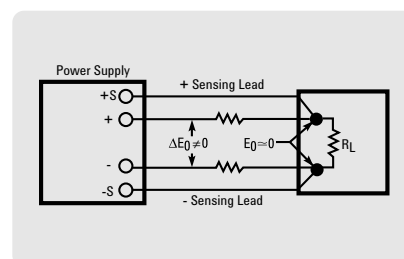
## Making Remote Error Sensing Connections

Normally a power supply operating in the constant voltage mode achieves its optimum line and load regulation, its lowest output impedance, drift, and PARD, and its fastest transient recovery performance at the power supply output terminals. If the load is separated from the output terminals by any lead length (as in Fig. 10), some of these performance characteristics will be degraded at the load terminals—usually by an amount proportional to the impedance of the load leads compared with the output impedance of the power supply.



**Figure 10**  
Load Voltage Variations Caused by Load Lead Voltage Drops when Remote Error Sensing is not Used

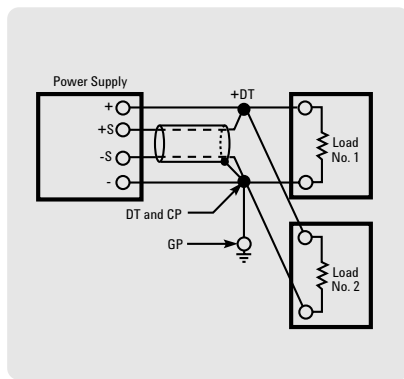
With remote error sensing, a feature included in nearly all Agilent power supplies, it is possible to connect the input of the voltage feedback amplifier directly to the load terminals so that the regulator performs its function with respect to the load terminals rather than with respect to the power supply output terminals. Thus, the voltage at the power supply output terminals shifts by whatever amount is necessary to compensate for the voltage drop in the load leads, thereby maintaining the voltage at the load terminals constant (Fig. 11).



**Figure 11**  
Regulated Power Supply with Remote Error Sensing.

### Making the Sensing Connections

**STEP 8.** Remove the jumper connections between the power supply sensing and output terminals, and connect the power supply sensing terminals to the DC distribution terminals as shown in Fig. 12.



**Figure 12**

Properly Grounded Power Supply System with Remote Error Sensing

Use an insulated shielded pair for the sensing leads. Do not use the shield as one of the sensing conductors.

**STEP 9.** Connect one end of the sensing lead shield to the DC common point and leave the other end unconnected.

In nearly all cases this method of connecting the sensing shield minimizes ripple at the DC distribution terminals.

### Protect Against Open Sensing Leads Step

**STEP 10.** Avoid the possibility of an open remote sensing path, either on a long-term or a transient basis.

Opening a sensing lead causes the power supply output voltage to increase. Protective circuits in the supply provide some load protection by limiting the amount of the increase, but eliminating all switch, relay, or connector contacts from the remote sensing path helps to minimize the possibility of any loss of regulation due to this cause.

### Check the Load Wire Rating

**STEP 11.** Verify that the voltage drop in the load leads does not exceed the capabilities of the remote sensing circuit.

Most well regulated power supplies have an upper limit to the load lead voltage drop around which remote sensing can be connected without losing regulation. This maximum voltage drop is typically 0.5, 1, or 2 volts, and may apply to the positive, the negative, or both the positive and negative output leads. See the instruction manual for the exact load lead voltage drop limitations of a particular power supply.

Remember too, that any voltage drop lost in the load leads reduces the maximum voltage available for use at the load. Either of these limitations sometimes dictates the use of a larger wire size than would be required by wire current rating or impedance considerations.

### Check for Power Supply Oscillation

**STEP 12.** Verify that the power supply does not oscillate when remote sensing is connected.

Although DC and low frequency performance are improved by remote sensing, phase shifts associated with long load and sensing leads can affect the stability of the feedback loop seriously enough to cause oscillation. This problem can frequently be corrected by readjusting a “transient recovery” or “loop stability” control inside the supply if the circuit includes one; follow the adjustment procedure in the manual. Another remedy that is often effective is to disconnect the output capacitor inside the power supply (some models have a rear panel jumper that can be removed for this purpose) and to connect a similar capacitor across the DC distribution terminals.

### Check for Proper Current Limit Operation

**STEP 13.** Check that the operating point of the current limit circuit has not been affected by the remote sensing connections.

With some power supply designs, the resistance of one of the output conductors adds to the resistance used for current limit monitoring when remote sensing is used. This reduces the threshold value at which current limiting begins and makes readjustment of the current limit



circuit necessary. To determine whether connecting remote sensing has changed the current limit setting, turn off the supply, short terminal -S to -OUT and +S to +OUT at the power supply, and check whether the current limit value differs from the value without these terminals shorted. If it does differ significantly, the current limit control needs readjustment.

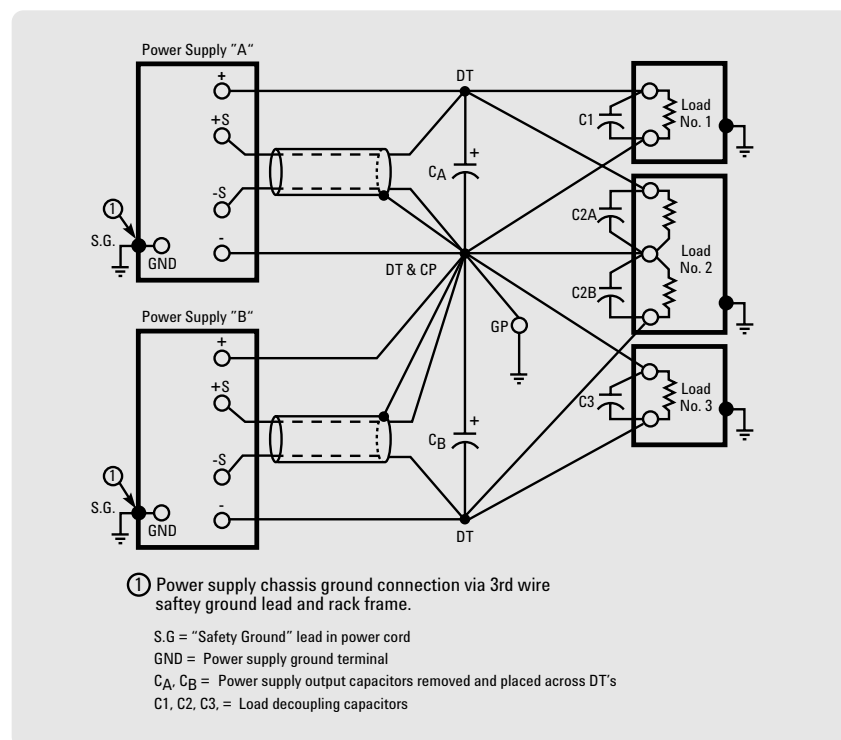
### Making Load Connections to Two or More Power Supplies in the Same System

The following four rules must also be observed in extending the preceding techniques to systems containing two or more power supplies.

#### DC Distribution Terminals

**RULE 1. There must be only one point of connection between the DC outputs of any two power supplies in the multiple power supply system. This point must be designated as one of the two DC distribution terminals for those two power supplies.**

Thus there are always exactly (N+1) DC distribution terminals in any system, where N is the number of power supplies. (This is true unless parallel supplies share the same distribution terminals, or supplies are connected in series with no other connections to their intermediate terminals).



**Figure 13**  
A Properly Connected Multiple  
Power Supply System

#### DC Common Point

**RULE 2. One of the (N+1) DC distribution terminals must be designated as the DC common point for the system.**

There can be only one DC common point allowed in a system.

#### DC Ground Point

**RULE 3. There must be only one DC ground point in a multiple power supply system.**

This rules out the possibility of connecting two grounded loads in the same system.

**RULE 4. There must be only one conductive path between the system DC common point and the system DC ground point.**

This rule is repeated from Step 7 above as a reminder because of the far greater number of possible paths to ground in a multiple power supply system. Figure 13 shows an example of a properly connected and grounded multiple power supply system.

**AC input current:** the maximum current into the power supply or electronic load. The current specified is worst case (low line voltage, full output).

**Actual transition time:** for an electronic load, either the total slew time (voltage or current change divided by slew rate - time) or the minimum transition time, whichever is longer.

**Auto-parallel operation:** a master-slave connection of the outputs of two or more supplies or the inputs of two or more electronic loads used for obtaining a current rating greater than can be obtained from a single load or supply. Only supplies that have the same voltage and current ratings should be paralleled.

**Auto-series operation:** a master-slave connection of the outputs of two or more supplies used for obtaining a voltage greater than can be obtained from one supply. Only supplies that have the same voltage and current ratings should be connected in series.

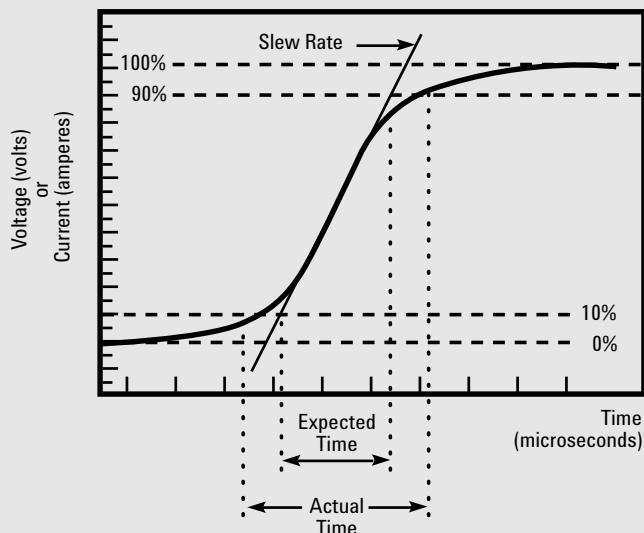
**Auto-tracking operation:** a master-slave connection of two or more supplies each of which has one of its output terminals in common with one of the output terminals of all of the other supplies.

**Command processing time:** the average time required for a power supply output voltage, or electronic load input voltage or current, to begin to change following receipt of a voltage or current set command over GPIB. This is effectively the time it takes for the power supply or electronic load to interpret the voltage set command and initiate a response.

**Common mode noise:** the current flowing from either output terminal (+ and -) through the power supply to chassis ground.

**Compliance voltage:** the output voltage of a power supply operating in the constant-current mode.

**Constant-current (CC) mode:** a power supply that stabilizes output current with respect to changes in load impedance. Thus, for a change in load resistance, the output current remains constant while the output voltage changes by whatever amount necessary to accomplish this.



Risetime Transition Limitation

**Ambient temperature:** the temperature of the air immediately surrounding the power supply or electronic load.

**Analog programming:** controlling the output voltage and/or current with an analog signal. This signal could be a voltage, current or resistance. This is similar to using the power supply as an amplifier.

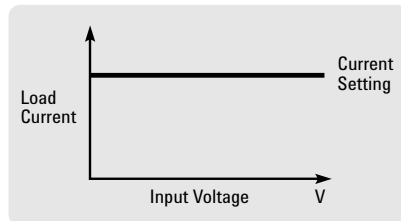
**Autoranging power supply:** a power supply that can provide maximum rated power over a wide and continuous range of voltage and current settings.

**Constant-current/voltage/resistance mode electronic load:** an electronic load that can operate in one of the following ways:

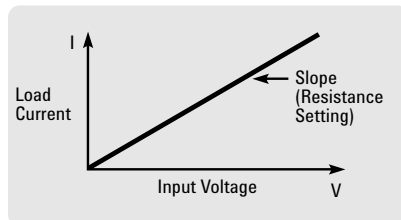
**CC=** ratio of voltage to current in accordance with the programmed value regardless of the input voltage

**CV=** ratio of voltage to current in accordance with the programmed value regardless of the input current

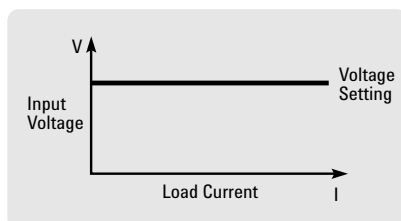
**CR=** ratio of voltage to current while maintaining the programmed resistance value



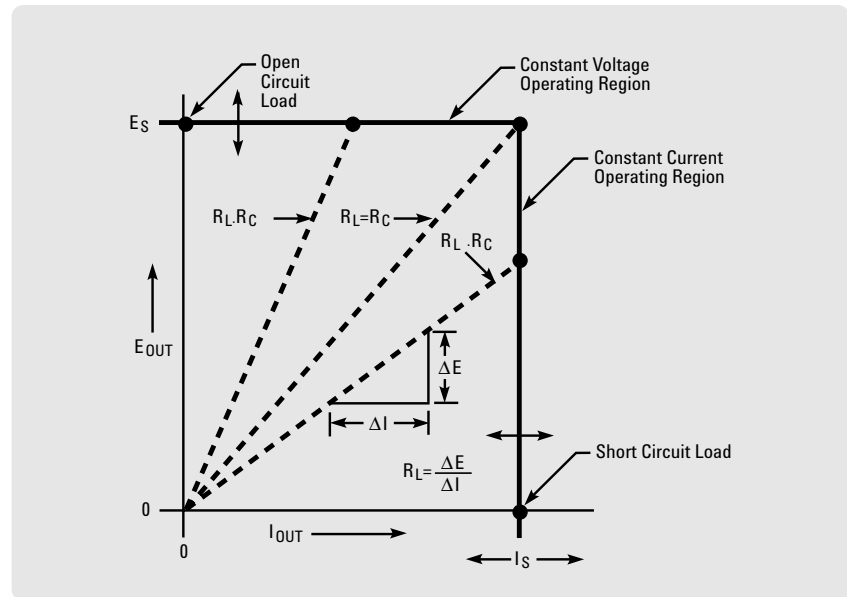
Constant-Current Mode



Constant-Resistance Mode



Constant-Voltage Mode



Constant-Voltage/Constant-Current Output Characteristics

**Constant-current/voltage/resistance regulation:** the change in the steady-state value of the stabilized electronic load input voltage, current, or resistance resulting from a full scale source change, with all other influence quantities held constant.

**Constant-voltage (CV) mode:** a power supply that stabilizes output voltage with respect to changes in influence quantities. Thus, for a change in load resistance, the output voltage remains constant while the output current changes by whatever amount necessary to accomplish this.

**Constant-voltage/constant current (CV/CC) power supply:** a power supply that operates as a constant-voltage power supply or a constant-current power supply, depending on load conditions. The supply acts as a constant-voltage source for comparatively large values of load resistance and as a constant-current source for comparatively small values of load resistance.

**Constant-voltage/current limiting**

**(CV/CL) power supply:** a power supply similar to a constant-voltage/constant-current supply except that at comparatively small values of load resistance, its output current is limited instead of being stabilized.

**Crest factor:** the ratio of the zero-to-peak value to the rms value of a waveform. This term is often used to specify the maximum peak amplitude that an AC power supply can source (relative to its maximum rms rating) without distortion.

**Crowbar:** see overvoltage protection.

**Current limiting:** the action, under overload or short-circuit conditions, of limiting the output current of a constant-voltage supply to some predetermined maximum value (fixed or adjustable) and automatically restoring the output voltage to its normal value when the overload or short circuit is removed. There are three types of current limiting:

- by constant-voltage/constant-current crossover
- by decreasing the output voltage as the current increases
- by decreasing both voltage and current as the load resistance decreases.

**DFI:** a TTL compatible output signal that can be used as an alarm and automatically initiates an action for multiple power supply or electronic load shutdown. The DFI signal is commonly connected to RI of the next supply. (See RI)

**Downprogramming:** the ability of a power supply to discharge its output capacitors independently of load.

The use of an active down programming device can reduce the fall time of the output voltage.

**Drift:** the maximum change of a power supply output or load input voltage or current during an 8-hour period following a 30-minute warmup, with all influence and control quantities maintained constant during the warm-up time and the period of drift measurement. Drift includes both periodic and random deviations over the bandwidth from zero frequency (DC) to a specified upper frequency limit.

**Efficiency:** expressed in percent, efficiency is the total output power of the supply divided by the active input power. Unless otherwise specified, Agilent measures efficiency at maximum rated output power and at worst case conditions of the AC line voltage.

**Electromagnetic interference (EMI):** any type of electromagnetic energy that could degrade the performance of electrical equipment. The EMI generated by a power supply can be propagated either by conduction (via the input and output leads) or by radiation from the units' case. The terms "noise" and "radio-frequency interference" (RFI) are sometimes used in the same context.

**Electronic Load:** an active device which absorbs power. Loads are used for the testing of the power producing products.

**Foldback:** immediate shutdown of the power supply output when a crossover between constant voltage and constant current mode occurs. Both the voltage and current levels are reduced (folded back).

**Harmonics:** the occurrence of this type of distortion is based upon the mathematical principle that all periodic waveforms are made up of a series of sine waves. As a result, harmonic distortion is produced at frequencies that are integer multiples of the fundamental or desired signal frequency. When viewed in the frequency domain, harmonics have an amplitude (often expressed in db), frequency, and phase characteristic relative to the fundamental.

**Isolation:** the maximum voltage (including output voltage) either output terminal may be floated from earth ground.

**Load cross regulation:** the affect on one output of a multiple output power supply when another output is programmed from zero to full rated current.

**Load Effect:** also known as “load regulation”. Load effect is the change in the steady-state value of the stabilized output voltage or current resulting from a full-load change in the load current of a constant-voltage supply or the load voltage of a constant-current supply, with all other influence quantities maintained constant.

**Load effect transient recovery time:** the time interval between a specified step change in the load current of a constant-voltage supply (usually a full-load or 5-amp change, whichever is smaller) or in the load voltage of a constant-current supply and the instant when the stabilized output quantity returns to and stays within a specified transient recovery band.

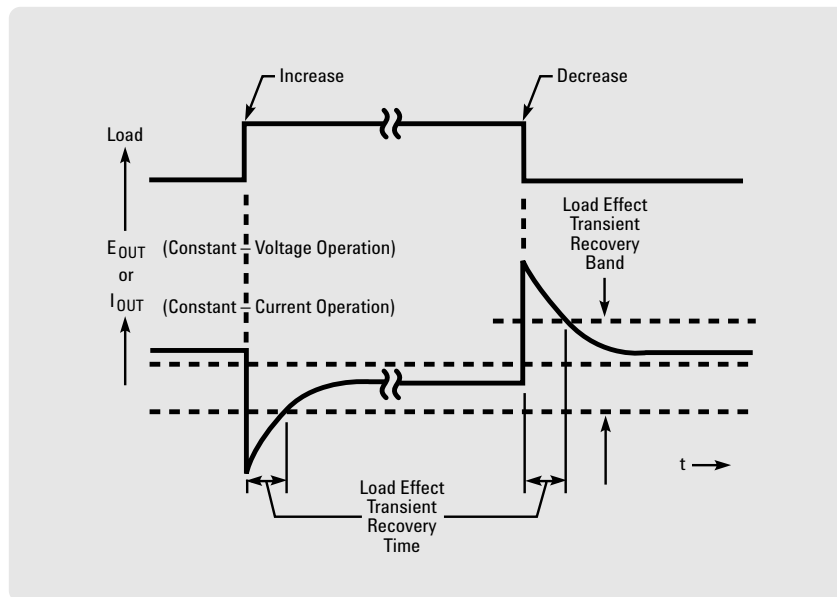
**Master-slave operation:** a method of interconnecting two or more supplies or electronic loads such that one of them (the master) serves to control the others (the slaves). The outputs of the slave supplies or inputs of the slave electronic loads always remain equal to or proportional to the output of the master. The outputs of the master supply and of one or more slaves may be connected in series, in parallel, or with just their negative or positive output terminals in common. (See also “complementary tracking”). The inputs of the master electronic load and one or more slaves may be connected in parallel only.

**Minimum transition time:** the shortest possible time in which an electronic load input can change from one level to another. This is determined by the small signal bandwidth of the load.

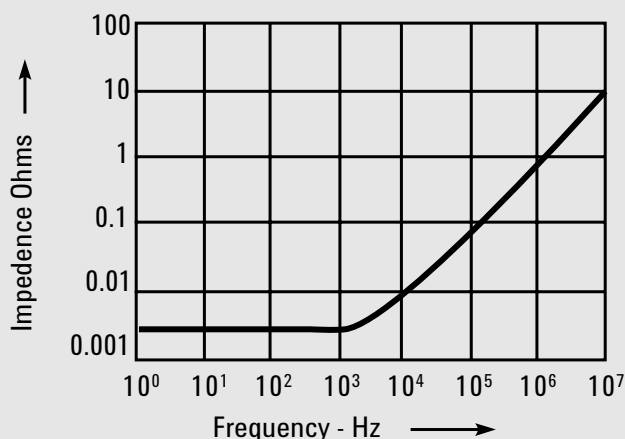
**Modulation:** analog programming of the output voltage and/or current. The output programming response time determines the maximum slew rate at which the power supplies output can be programmed.

**Nominal value:** the value that exists “in name only”; not the actual value. For example, in the case of a power supply with a calibrated output control, the nominal value is the value indicated by the control setting. For a supply with a fixed output, the nominal output is the output indicated on the nameplate. The nominal value of a 120-volt  $\pm 10\%$  line voltage is 120 volts.

**“One-Box”:** a power supply that can be controlled by direct connection to a computer (with no additional programmers) and that can provide measured data to a computer without external voltmeters or ammeters.



Load Effect Transient Recovery Waveforms



Typical Output Impedance of a Constant Voltage Power Supply

**Output Impedance:** at any frequency of load change,  $\Delta E_{out}/\Delta I_{out}$ . Strictly speaking, the definition applies only for a sinusoidal load disturbance, unless the measurement is made at zero frequency (DC). The output impedance of an ideal constant voltage power supply would be zero at all frequencies, while the output impedance for an ideal constant current power supply would be infinite at all frequencies.

**Overcurrent protection:** protection of the power supply, electronic load and/or connected equipment against excessive output current.

**Overvoltage protection:** protection of the power supply, electronic load and/or connected equipment against excessive output voltage. Overvoltage protection is usually by means of a crowbar protection circuit, which rapidly places a low resistance shunt across the supply's output terminals to reduce output voltage to a low value if a predetermined voltage is exceeded. A supply equipped with an overvoltage crowbar must also be protected by a means for limiting or interrupting the output current.

**Peak-to-peak noise:** is the range between maximum and minimum noise level. Sometimes called noise "spikes." Peak-to-peak noise is typically low in energy and does not show up in a RMS measurement, 20-20 Mhz.

**Phase angle:** specifies the time domain phase relationship between two sine waves. The unit of phase angle is the degree, with one cycle corresponding to 360 degrees of phase.

**Programming speed:** the maximum time required for the programmed output voltage or current to change from a specified initial value (usually zero or maximum output) to a value within a specified tolerance band of a specified newly programmed value (for most models 99.9% or 0.1% of maximum output, respectively) following the onset of a step change in an analog programming signal, or the gating of a digital signal.

**Readback:** the ability of a power supply or electronic load to measure its actual output voltage and/or current, and provide the reading to a computer.

**Remote sensing:** remote sensing, or remote error sensing, is a means by which a power supply or electronic load monitors the stabilized voltage directly at the load or source respectively, using extra sensing leads. The resulting circuit action compensates for voltage drops up to a specified limit in the load leads.

**Resolution:** for a bench supply, the smallest change in output voltage or current that can be obtained using the front panel controls. For a system supply or electronic load, the smallest change that can be obtained using either the front panel controls, or a computer.

**Reverse voltage protection:** protection of the power supply or electronic load against reverse voltage applied at the output input terminals.

**RI (discrete fault indicator/remote inhibit):** a rear-panel port that can be used to disable the power supply output independently of the GPIB. This port can also be used to chain multiple power supplies together such that an emergency shutdown of one output automatically signals the other supplies to disable their outputs.

**Ripple and Noise (dB):** a term often used to specify rms or peak AC source noise relative to the maximum rms or peak output rating. The specification is calculated as follows:  $\text{dB} = 20 \text{ Log } (\text{Vnoise}/\text{Vrating})$ .

**Rms (or effective) amplitude or noise:** an average signal or noise level based on energy content. The root mean square (rms) content is often called the AC component.

**SCPI (Standard Commands for Programmable Instruments):** is a programming language for controlling instrument functions over the GPIB (IEEE 488) instrument bus. The same SCPI commands and parameters control the same functions in different classes of instruments.

**Serial link:** a means by which up to 16 power supplies with this feature can share one GPIB primary address. The power supplies can be connected with cables similar to U.S. modular telephone cables. They are independently controlled using GPIB secondary addressing.

**Series regulation:** power supplies designed with this topology have fast programming speeds and low noise. Also referred to as a “linear” topology.

**Slave operation:** see “master-slave operation”.

**Slew rate:** for any given electronic load input transition, the change in current or voltage over time.

**Source effect:** also known as “line regulation”, source effect is the change in the steady-state value of the stabilized output or input voltage or current resulting from any change in the AC source voltage within its specified range, with all other influence quantities maintained constant. Source effect may be measured at any output or input voltage and current within rating.

**Specifications:** describe the power supply or electronic load warranted performance.

**Supplemental characteristics:** give typical but nonwarranted performance parameters.

**Switching regulation supplies:** power supplies designed with this topology are efficient and can have laboratory-grade specifications.

**Temperature effect coefficient:** the maximum steady-state change in a power supply’s output voltage or current or electronic load’s input voltage or current per degree Celsius following a change in the ambient temperature within specified limits, with all other influence quantities maintained constant.

**Total harmonic distortion:** the ratio of the rms sum of the harmonic components to the rms value of a periodic waveform. This is typically expressed as a percent or in decibels (dB).

**Voltage limiting:** the action of limiting the output voltage of a constant-current supply to some predetermined maximum value (fixed or adjustable) and automatically restoring the output current to its normal value when the load conditions are restored to normal. There are two types of voltage limiting:

- by constant voltage/constant current crossover
- by decreasing the output current as the voltage increases

**Warm-up time:** the time interval from when a power supply or electronic load is turned on until its output complies with all performance specifications.

# Data Acquisition/Switch Instruments

Selection Guide	34970A Data Acquisition Switch Unit	34980A Multifunction Switch/Measure Unit
Number of Available slots & modules	3 slots & 8 modules	8 slots & 19 modules
Available Module Functionality		
Integrated DMM	6 1/2 digit	6 1/2 digit
Max Scan Speed	250 ch/s	1000 ch/s
Max 2-wire Mux Channels	60	560
Max 2-wire Matrix Crosspoints	96	1024
Max Voltage	300 V	300 V
Max Switching Current	1 A	5 A
Max Counter/Totalizer Frequency	100 KHz	10 MHz
Max Digital I/O Channels	48 ch	510 ch
Max Analog Outputs	6 ch	32 ch
Max RF Frequency	2 GHz	3 GHz
Max Microwave Frequency	N/A	20 GHz
Breadboard (for custom circuits)		available
Web Interface (via web browser)		yes
Connectivity	GPIB, RS-232, Optional USB w/ 82357A BenchLink Data Logger SW	LAN, USB, GPIB IntuiLink SW

More detailed specifications at [www.agilent.com/find/dataacquisition](http://www.agilent.com/find/dataacquisition)

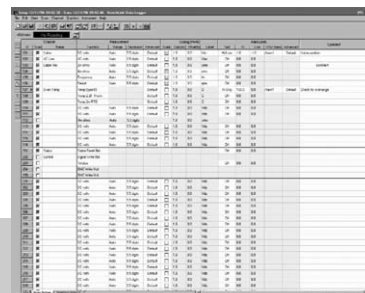




34970A

## Low-Cost Data Acquisition/Switch 34970A

- 3-slot data acquisition and switching mainframe
- 6½-digit (22 bit) internal DMM
- 11 built-in measurement functions
- 8 switch and control plug-in modules
- BenchLink data logger software included



### 34970A Data Acquisition/Switch Unit

The Agilent 34970A is a high performance, low-cost data acquisition and switching mainframe ideal for data logging, data acquisition, and general-purpose switching and control applications. It consists of a half-rack mainframe with an internal 6½ digit (22 bit) digital multimeter. Three module slots are built into the rear of the unit to accept a combination of switch and control modules. Whether you need a few channels of simple data logging or a hundred channels of ATE performance, the 34970A meets your data acquisition needs at a price that meets your budget.

### Measurements You Can Trust

The 34970A incorporates the measurement engine from our best-selling benchtop digital multimeter (DMM). You get the benefit of proven Agilent performance, universal inputs with built-in signal conditioning, and modular flexibility, all in a low-cost, compact data acquisition package. The 34970A features 6½ digits (22 bits) of resolution, 0.004% basic dcV accuracy, and ultra-low reading noise. Combine that with scan rates of up to 250 channels/sec, and you've got the speed and accuracy you need to get the job done.

### Custom Configurations That Grow With You

Three module slots and eight switch and control modules allow you to customize the 34970A to meet your unique requirements. Buy only what you need, and add more modules later as your application grows. Measure up to 120 inputs with a single half-rack unit.

### Free BenchLink Software Simplifies Your Data Gathering

If you want PC-based data logging capabilities, but don't want to spend hours programming, BenchLink Data Logger is the answer. Use it to set up your test, acquire and archive measurement data, and perform real-time display and analysis of the incoming measurements.

A familiar spreadsheet environment makes it easy to configure and control your tests. A rich set of colorful graphics provides many options for displaying your data – all with point-and-click ease. Set up multiple graphics using strip charts, histograms, or individual channel results and more. Also use Agilent BenchLink Data Logger to easily move data to other applications for further analysis, or for inclusion in your presentations and reports.

### Powerful Flexibility

The 34970A's unique design allows per-channel configurability for maximum flexibility and quick, easy setup. The internal autoranging DMM measures 11 different functions directly, eliminating the need for expensive external signal conditioning. Temperature conversion routines are built-in to display raw thermocouple, RTD, or thermistor inputs in degrees C, F, or Kelvin. Use Mx+B scaling to convert linear transducer outputs directly into engineering units. You can even set high/low alarm limits to warn you of out-of-tolerance conditions.

### Applications

#### Data Logging

Configured with the 34901A 20-channel relay multiplexer, the 34970A becomes a rugged, low-cost data logger that's ideal for quick tests in the lab or in the field. An intuitive front panel with self-guiding menus and a bright, easy-to-read vacuum fluorescent display make standalone set-up fast and easy. All readings are automatically time stamped and stored in a 50,000 reading memory – enough memory to hold a week's worth of data (20 channels scanned every five minutes). The non-volatile memory holds your data even after power is

## Low-Cost Data Acquisition/Switch 34970A (Continued)

## Module Specifications

removed, so you can use the 34970A to collect data at a remote location for later uploading to a PC. The system configuration is also held in non-volatile memory, so in the event of a power failure the unit automatically resumes scanning when power is returned. And for PC-based testing, Agilent BenchLink Data Logger software is included to simplify your test configurations, data analysis and data management.

**Automated Testing**

For automated test and benchtop automation applications, the 34970A's three slots and choice of eight plug-in switch and control modules allow easy customization. The 6½-digit internal DMM brings you the power and performance of a world-class standalone DMM, but in a fraction of the space and at a fraction of the cost. Software drivers that support Agilent VEE and National Instruments LabVIEW™ are available to make an easy integration of the 34970A into your test system. Standard RS-232 and GPIB interfaces and SCPI programming language make integration even easier. Our proprietary relay maintenance system automatically counts and stores every individual switch closure to help you predict relay end-of-life and avoid costly production line downtime.

**Module Overview**

Up to three modules, in any combination, can be inserted into a single mainframe. The 34970A's internal DMM connections are accessible only through the 34901A, 34902A, and 34908A multiplexers.

Module Description	Type	Connects to Internal DMM	Speed (ch./sec.)	Maximum Input			Offset Voltage	Bandwidth	Comments
				Voltage	Current	Power			
<b>34901A</b> 20-ch. Multiplexer	2-wire armature (4-wire selectable)	Yes	60	300 V	1 A	50 W	<3 µV	10 MHz	2 current channels (22 ch. Total) Built-in cold junction reference
<b>34902A</b> 16-ch. Multiplexer	2-wire reed (4-wire selectable)	Yes	250	300 V	50 mA	2 W	<6 µV	10 MHz	Built-in cold junction reference
<b>34903A</b> 20-ch. Actuator/GP Switch	SPDT/form C	No	120	300 V	1 A	50 W	<3 µV	10 MHz	—
<b>34904A</b> 4 x 8 Matrix	2-wire armature	No	120	300 V	1 A	50 W	<3 µV	10 MHz	Full crosspoint
<b>34905A</b> Dual 1:4 RF Mux, 50 Ω	Common Low (unterminated)	No	60	42 V	0.7 A	20 W	<6 µV	2 MHz	1 GHz through provided BNC-to-SMB adapter cables
<b>34906A</b> Dual 1:4 RF Mux, 75 Ω	Common Low (unterminated)	No	60	42 V	0.7 A	20 W	<6 µV	2 MHz	1 GHz through provided BNC-to-SMB adapter cables
<b>34907A</b> Multifunction Module	Two 8-bit digital I/O ports	No	—	42 V	400 mA	—	—	—	Open drain Gated; selectable input threshold
	26-bit event counter	—	—	42 V	—	—	—	100 kHz	16-bit, earth referenced
	Two analog outputs	—	—	± 12 V	10 mA	—	—	DC	
<b>34908A</b> 40-ch. Single-ended Mux	1-wire armature (common low)	Yes	60	300 V	1 A	50 W	<3 µV	10 MHz	No 4-wire measurements built-in cold junction reference

More detailed specifications at [www.agilent.com/find/34970A](http://www.agilent.com/find/34970A)

## Low-Cost Data Acquisition/Switch 34970A (Continued)

**Switching**

For test applications that don't require the built-in measurements of the 34970A, the unit can be ordered without the internal DMM. This provides an ultra low-cost solution for routing test signals to and from your device-under-test and assorted instruments, including external DMMs, scopes, counters and power supplies. Plus, you can add the DMM later if your needs change.

**Accuracy Specifications<sup>1</sup>**

±(% of reading + % of range)

Includes measurement error, switching error and transducer conversion error

Function	Range <sup>2</sup>	Frequency, etc.	1 Year <sup>2</sup> 23°C ± 5°C
<b>DC Voltage</b>	100.0000 mV	—	0.0050 + 0.0040
	1.000000 V	—	0.0040 + 0.0007
	10.00000 V	—	0.0035 + 0.0005
	100.0000 V	—	0.0045 + 0.0006
	300.0000 V	—	0.0045 + 0.0030
<b>True RMS AC Voltage<sup>3</sup></b>	100.0000 mV to 100.0000 V	3 Hz – 5 Hz	1.00 + 0.04
		5 Hz – 10 Hz	0.35 + 0.04
		10 Hz – 20 kHz	0.06 + 0.04
		20 kHz – 50 kHz	0.12 + 0.05
		50 kHz – 100 kHz	0.60 + 0.08
		100 kHz – 300 kHz <sup>4</sup>	4.00 + 0.50
	300.0000 V	3 Hz – 5 Hz	1.00 + 0.08
		5 Hz – 10 Hz	0.35 + 0.08
		10 Hz – 20 kHz	0.06 + 0.08
		20 kHz – 50 kHz	0.12 + 0.12
		50 kHz – 100 kHz	0.60 + 0.20
		100 kHz – 300 kHz <sup>4</sup>	4.00 + 1.25
<b>Resistance<sup>5</sup></b>	100.0000 Ω	1 mA current source	0.010 + 0.004
	1.000000 kΩ	1 mA	0.010 + 0.001
	10.00000 kΩ	100 μA	0.010 + 0.001
	100.0000 kΩ	10 μA	0.010 + 0.001
	1.000000 MΩ	5.0 μA	0.010 + 0.001
	10.00000 MΩ	500 nA	0.040 + 0.001
	100.0000 MΩ	500 nA 10 MΩ	0.800 + 0.010
<b>Frequency and Period<sup>6</sup></b>	100 mV to 300 V	3 Hz – 5 Hz	0.10
		5 Hz – 10 Hz	0.05
		10 Hz – 40 Hz	0.03
		40 Hz – 300 kHz	0.01
<b>DC Current</b> (34901A only)	10.00000 mA	<0.1 V burden	0.050 + 0.020
	100.0000 mA	<0.6 V	0.050 + 0.005
	1.000000 A	<2 V	0.100 + 0.010
<b>True RMS AC Current</b> (34901A only)	10.00000 mA to 1.00000 A	3 Hz – 5 Hz	1.00 + 0.04
		5 Hz – 10 Hz	0.30 + 0.04
		10 Hz – 5 Hz	0.10 + 0.04
	100.0000 mA <sup>7</sup>	3 Hz – 5 Hz	1.00 + 0.5
		5 Hz – 10 Hz	0.30 + 0.5
		10 Hz – 5 kHz	0.10 + 0.5

<sup>1</sup> Specifications are for 1-hour warm-up and 6 ½ digits, slow AC filter.

<sup>2</sup> 20% over range on all ranges except 300 Vdc and AC ranges and 1 A DC and AC current ranges.

<sup>3</sup> For sinewave input >5% of range. For inputs from 1% to 5% of range and <50 kHz, add 0.1% of range additional error.

<sup>4</sup> Typically 30% of reading error at 1 MHz, limited to 1 x 10<sup>8</sup> V Hz.

<sup>5</sup> Specifications are for 4-wire ohms function or 2-wire ohms using scaling to remove the offset. Without scaling, add 4 Ω additional error in 2-wire ohms function.

<sup>6</sup> Input >100 mV. For 10 mV inputs, multiply % of reading error x 10.

<sup>7</sup> Specified only for inputs >10 mA.

<sup>8</sup> For total measurement accuracy, add temperature probe error.

<sup>9</sup> Thermocouple specifications not guaranteed when 34907 module is present

Temperature	Type	1-Year Accuracy <sup>8</sup>	
<b>Thermocouple<sup>9</sup></b>	B	1100°C to 1820°C	1.2°C
	E	-150°C + 1000°C	1.0°C
	J	-150°C + 1200°C	1.0°C
	K	-100°C + 1200°C	1.0°C
	N	-100°C + 1300°C	1.0°C
	R	300°C + 1760°C	1.2°C
	S	400°C + 1760°C	1.2°C
	T	-100°C + 400°C	1.0°C
<b>RTD</b>	R <sub>0</sub> from 49 Ω to 2.1 kΩ	-200°C + 600°C	0.06°C
<b>Thermistor</b>	2.2 k, 5 k and 10 k	-80°C to 150°C	0.08°C

See manual or datasheet for more information

More detailed specifications at [www.agilent.com/find/34970A](http://www.agilent.com/find/34970A)

## Low-Cost Data Acquisition/Switch 34970A (Continued)

Measurement Characteristics		
<b>DC Voltage</b>	Measurement Method A-D Linearity Input Resistance 100 mV, 1 V, 10 V ranges 100 V, 300 V ranges Input Bias Current Input Protection	Continuously integrating multi-slope III A-D Converter 0.0002% of reading + 0.0001% of range Selectable 10 M $\Omega$ or >10.000 M $\Omega$ 10 M $\Omega$ $\pm$ 1% <30 pA at 25°C 300 V all ranges
<b>True RMS AC Voltage</b>	Measurement Method Crest Factor Additional Crest Factor Errors (non-sinewave) Input Impedance Input Protection	AC coupled True RMS – measures the AC component of the input with up to 300 Vdc of bias on any range Maximum of 5:1 at full scale Crest Factor 1–2 0.05% of reading Crest Factor 2–3 0.15% of reading Crest Factor 3–4 0.30% of reading Crest Factor 4–5 0.40% of reading 1 M $\Omega$ $\pm$ 2% in parallel with 150 pF 300 Vrms all ranges
<b>Resistance</b>	Measurement Method Offset Compensation Maximum Lead Resistance Input Protection	Selectable 4-wire or 2-wire Ohms Current source referenced to LO input Selectable on 100 $\Omega$ , 1 k $\Omega$ , 10 k $\Omega$ ranges 10% of range per lead for 100 $\Omega$ and 1 k $\Omega$ ranges 1 k $\Omega$ on all other ranges 300 V on all ranges
<b>Frequency and Period</b>	Measurement Method Voltage Ranges Gate Time Measurement Timeout	Reciprocal counting technique Same as AC voltage function 1 s, 100 ms, or 10 ms Selectable 3 Hz, 20 Hz, 200 Hz LF limit
<b>DC Current</b>	Shunt Resistance Input Protection	5 $\Omega$ for 10 mA, 100 mA; 0.1 $\Omega$ for 1 A 1 A 250 V fuse on 34901A module
<b>True RMS AC Current</b>	Measurement Method Shunt Resistance Input Protection	Direct coupled to the fuse and shunt, AC coupled True RMS measurement (measures the AC component only) 5 $\Omega$ for 10 mA; 0.1 $\Omega$ for 100 mA, 1 A 1 A 250 V fuse on 34901A module
<b>Thermocouple</b>	Conversion Conformity Reference Junction Type Open Thermocouple Check	ITS-90 based software routines Internal, Fixed, or External Selectable per channel, Open >5 k $\Omega$
<b>Thermistor</b>		44004, 44007, 44006 series
<b>RTD</b>		$\alpha$ = 0.00385 (DIN) and $\alpha$ = 0.00391
<b>Measurement Noise Rejection 60 (50) Hz<sup>1</sup></b>	DC CMRR AC CMRR Integration Time 200 plc/3.33 s (4 s) 100 plc/1.67 s (2 s) 20 plc/334 ms (400 ms) 10 plc/167 ms (200 ms) 2 plc/33.3 ms (40 ms) 1 plc/16.7 ms (20 ms) <1 plc	140 dB 70 dB Normal Mode Rejection <sup>2</sup> 110 dB <sup>3</sup> 105 dB <sup>3</sup> 100 dB <sup>3</sup> 95 dB 90 dB 60 dB 0 dB

<sup>1</sup> For 1 K $\Omega$  unbalance in LO lead<sup>2</sup> For power line frequency  $\pm$ 0.1%<sup>3</sup> For power line frequency  $\pm$ 1% use 80 dB or  $\pm$ 3% use 60 dB<sup>4</sup> Reading speeds for 60 Hz and (50 Hz) operation<sup>5</sup> For fixed function and range, readings to memory, scaling and alarms off, AZERO OFF<sup>6</sup> Maximum limit with default settling delays defeated<sup>7</sup> Speeds are for 4½ digits, delay 0, display off, autozero off, using 115 kbaud RS-232 setting<sup>8</sup> Isolation voltage (ch-ch, ch-earth) 300 Vdc, AC rms<sup>9</sup> 6½ digits = 22 bits, 5½ digits = 18 bits, 4½ digits = 15 bits<sup>10</sup> Assumes relative time format (time since start of scan)More detailed specifications at [www.agilent.com/find/34970A](http://www.agilent.com/find/34970A)

## Low-Cost Data Acquisition/Switch 34970A (Continued)

Operating Characteristics<sup>4</sup>Single Channel Measurement Rates<sup>5</sup>

Function	Resolution <sup>9</sup>	Reading/s
<b>dcV, 2-wire Resistance</b>	6½ digits (10 plc) 5½ digits (1 plc) 4½ digits (0.02 plc)	6 (5) 57 (47) 490
<b>Thermocouple</b>	0.1°C (1 plc) (0.02 plc)	49 (47) 280
<b>RTD, Thermistor</b>	0.01°C (10 plc) 0.1°C (1 plc) 1°C (0.02 plc)	6 (5) 47 (47) 280
<b>acV</b>	6½ Slow (3 Hz) 6½ Med (20 Hz) 6½ Fast (200 Hz) 6½ <sup>3</sup>	0.14 1 8 100
<b>Frequency, Period</b>	6½ digits (1s gate) 5½ digits (100 ms) 4½ digits (10 ms)	1 9 70

System Speeds <sup>7</sup>	Channel/s
<b>INT0 Memory</b>	Single Channel dcV 490 34902A scanning dcV 250 34907A scanning digital in 250 34902A scanning dcV with scaling and 1 alarm fail 220 34907A scanning totalize 170 34902A scanning temperature 160 34902A scanning acV 100 34902A scanning dcV/Ohms on alternate channels 90 34901A/34908A scanning dcV 60
<b>INT0 and OUT of Memory to GPIB or RS-232 (init/fetch)</b>	34902A scanning dcV 180 34902A scanning dcV with timestamp 150
<b>OUT of Memory to GPIB<sup>10</sup></b>	Readings 800 Readings with timestamp 450 Readings with all format options ON 310
<b>OUT of Memory to RS-232</b>	Readings 600 Readings with timestamp 320 Readings with all format options ON 230
<b>DIRECT to GPIB or RS-232</b>	Single channel dcV 440 34902A scanning dcV 200 Single channel MEAS DCV10/MEAS DCV 1 25 Single channel MEAS DCV/MEAS OHMS 12

<sup>1</sup> For 1 KΩ unbalance in LO lead<sup>2</sup> For power line frequency ±0.1%<sup>3</sup> For power line frequency ±1% use 80 dB or ±3% use 60 dB<sup>4</sup> Reading speeds for 60 Hz and (50 Hz) operation<sup>5</sup> For fixed function and range, readings to memory, scaling and alarms off, AZERO OFF<sup>6</sup> Maximum limit with default settling delays defeated<sup>7</sup> Speeds are for 4½ digits, delay 0, display off, autozero off, using 115 kbaud RS-232 setting<sup>8</sup> Isolation voltage (ch-ch, ch-earth) 300 Vdc, AC rms<sup>9</sup> 6½ digits = 22 bits, 5½ digits = 18 bits, 4½ digits = 15 bits<sup>10</sup> Assumes relative time format (time since start of scan)More detailed specifications at [www.agilent.com/find/34970A](http://www.agilent.com/find/34970A)

## Low-Cost Data Acquisition/Switch 34970A (Continued)

## Ordering Information

**34970A** Data Acquisition/Switch Unit  
Includes internal 6½ digit DMM, operating and service manuals, test report, power cord, and Quick Start package (includes Agilent BenchLink Data Logger software, RS-232 cable, thermo-couple, and screwdriver). Modules are purchased separately and are required to operate.

**34970A-001** Delete Internal DMM  
Same as above but deletes DMM and quick start package  
Order 34970-80010 to retrofit DMM at a later time

**34970A-1CM** Rackmount Kit

**34970A-0B0** Delete Manual Set

**34901A** 20-Channel Armature Multiplexer

**34902A** 16-Channel Reed Multiplexer

**34903A** 20-Channel Actuator/General Purpose Switch

**34904A** 4 x 8 Two-Wire Matrix Switch

**34905A** Dual 4-Channel RF Multiplexer, 50 Ohms (Includes (10) SMB-to-BNC(f) 50 Ω adapter cables)

**34906A** Dual 4-Channel RF Multiplexer, 75 Ohms (Includes (10) SMB-to-BNC(f) 75 Ω adapter cables)

**34907A** Multifunction Module

**34908A** 40-Channel Single-Ended Multiplexer

## Accessories

**34161A** Accessory Pouch

**34131A** Hard Carrying Case

**E5810A** LAN/GPIB Gateway

**82357A** USB to GPIB Converter

**34970-80010** DMM Field Installation Kit (Fully calibrated with Test Report and Quick Start Kit)

## System Characteristics

<b>Scanning Inputs</b>	Analog Digital Scan List	34901A, 34902A, and 34908A multiplexer channels 34907A digital in and totalize Scans channels in ascending order
<b>Triggering</b>	Source  Scan count Scan interval Channel delay External trig delay External trig jitter	Interval, external, button press, software, or on monitor channel alarm 1 to 50,000 or continuous 0 to 99 hours; 1 ms step size 0 to 60 seconds per channel; 1 ms step size <300 μs. With monitor on <200 ms <2 ms
<b>Alarms</b>	Analog inputs Digital inputs  Monitor channel Alarm outputs Latency	Hi, Lo, or HI + Lo evaluated each scan 34907A digital in: maskable pattern match or state change 34907A totalize: Hi limit only Alarm evaluated each reading 4 TTL compatible; selectable TTL logic Hi or Lo on fail 5 ms (typical)
<b>Memory</b> (Battery backed, 4 year typical life <sup>1</sup> )	Readings States Alarm queue	50,000 with timestamp; Readable during scan 5 instrument states with user label Up to 20 events with channel number, reading, and timestamp
<b>System Features</b>	Per-channel math  Power fail recovery Relay maintenance  Real time clock	Individual Mx + B scaling and Min/Max/Average calculated real time Resumes scanning automatically Counts each relay closure and stores on module. User resettable. Battery-backed, 4 year typical life <sup>1</sup>
<b>General Specifications</b>	Power supply Power line frequency Power consumption Operating environment  Storage environment Weight Safety RFI and ESD	100 V/120 V/220 V/240 V ±10% 45 Hz to 66 Hz automatically sensed 12 W (25 VA peak) Full accuracy for 0°C to 55°C Full accuracy to 80% R.H. at 40°C -40°C to 70°C <sup>1</sup> Net: 3.6 kg (8.0 lbs) Conforms to CSA, UL-1244, IEC 1010 Cat 1 CISPR 11, IEC 801/2/3/4
<b>Software</b> <b>Agilent BenchLink Data Logger</b> (not included with Option 001)		
<b>System Requirements<sup>2</sup></b>	Operating System   Controller  RAM Disk Space Display	Windows 98SE, NT <sup>®</sup> 4.0 SP6a, 2000 SP4, XP, Adobe <sup>®</sup> Acrobat <sup>®</sup> Reader V5.0 or higher (to view documentation) Microsoft <sup>®</sup> Internet Explorer V5.0 or higher (required when using Windows NT) Recommended Pentium <sup>®</sup> 4, 800 MHz or greater, Min: Pentium III, 500 MHz Recommended 256 MB or greater, Min 128 MB Recommend 200 MB, Min 70 MB 800 x 600 resolution, 256 colors
<b>Computer Interfaces<sup>3</sup></b>	GPIB LAN-to-GPIB USB-to-GPIB	Agilent and National Instruments PCI-GPIB E5810A 82357A RS-232 (Serial Port) PC COM 1-4

<sup>1</sup> Storage at temperature above 40°C will decrease battery life

<sup>2</sup> Software provided on CD-ROM and includes utility to create floppy disks for installation

<sup>3</sup> Interface and driver must be purchased and installed separately

<sup>4</sup> 90 MHz Pentium, 20 MB RAM

<sup>5</sup> Requires VISA command library for IEEE-488

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More detailed specifications at [www.agilent.com/find/34970A](http://www.agilent.com/find/34970A)



34980A

## Multifunction Switch/Measure Mainframe and Modules 34980A

8-slot mainframe with 19 mix-and-match plug-in modules

Up to 560 2-wire multiplexer channels or 1024 matrix cross-points

Optional built-in 6½ digit DMM

LAN, USB 2.0, and GPIB connectivity

Built in graphical interface



### High-performance Unit Provides Low-cost Alternative to PXI/VXI Switch & Measurement Platforms

If you use automated test equipment for design validation or manufacturing, you now have a cost-effective alternative to PXI and VXI based test-system platforms. The 34980A multifunction switch/measure unit provides comparable functionality that is much easier to use than PXI and VXI and costs less. The 34980A helps you lower your cost of test and accelerate your test-system integration and development.

The 34980A handles system switching up to 20 GHz and provides basic measurements and system control. It also offers DMM measurements, counter/totalizer functionality, digital I/O with pattern capabilities, and analog outputs with basic waveforms – all in one low-cost, compact box. And with its standard connectors, software drivers, computer-standard I/O, and Web browser interface, the 34980A easily integrates into electronic functional test and data acquisition systems.

### Flexible Switching, Measurements, and System Control

The 34980A accommodates up to 8 plug-in modules to give you the flexibility you need. Choose from 19 different modules to define your own configuration. You can buy what you need now and add to it or reconfigure it as your requirements change.

Whether you are measuring temperature, AC or DC voltage, resistance, frequency, current, or custom measurements, the 34980A offers the functionality you need in a single box. Switch in different measurements with high-performance signal switching – no external signal conditioning is required. Choose between different switch types and topologies with frequency ranges from DC to 20 GHz. The 34980A offers high-density multiplexers for scanning multiple channels, matrices for connecting multiple points at one time, and general purpose switches for simple control and high power needs.

The 34980A also offers flexible choices for system control. You can control external devices such as microwave switches, attenuators, solenoids, and power relays. Or use the digital inputs to sense limit-switch and digital-bus status.

The rugged instrument comes with a variety of system-ready features:

- Web browser interface shows settings at a glance and provides remote access and control
- Self-guiding front panel to configure, troubleshoot or view data
- Low EMI and efficient system cooling
- Heavy-duty cabling and connection options
- Rack mount options
- Relay counters help predict end-of-life

## Multifunction Switch/Measure Mainframe and Modules 34980A (Continued)

- In-rack calibration for reduced maintenance time
- DMM measurement accuracies include the switch for simple calculations

Make system connections easily and quickly with simple, reliable connection options:

- Built-in Ethernet, USB 2.0, and GPIB connectivity
- Low-cost, standard 50- or 78-pin Dsub connectors and cables
- Detachable terminal blocks with strain relief
- Mass interconnect solutions

The 34980A also has easier signal routing using four 2-wire internal analog buses. You can route your measurements directly to the internal DMM, or you can connect to external instruments through the analog bus connector on the rear of the mainframe. And since you have four 2-wire buses, you can dedicate one bus for use with the internal DMM and use the other three buses for module extensions or additional signal routing between modules, reducing your wiring needs.

### Measurements You Can Trust

Get proven performance from Agilent instruments, with the resolution, repeatability, speed, and accuracy you've come to expect.

The 34980A offers built-in signal conditioning and modular flexibility. When you use it with the internal DMM, you can configure each channel independently for the measurements you choose. It includes a variety of features that give you confidence in your measurements:

- 6½ digits of resolution with .004% of accuracy with DC voltage measurements
- Alarms per channel – high limit, low limit, or both
- Math functions – use  $Mx+B$  for custom linear conversions and converting raw inputs
- Built-in thermocouple reference for temperature measurements (34921T)
- Time-stamped readings

The integrated DMM is mounted inside the mainframe and does not consume any of the eight user-available slots and gives you the flexibility to measure 11 types of inputs:

- Temperature with thermocouples, RTDs, or thermistors (with 34921A)
- DC and AC voltage
- 2- and 4-wire resistance
- Frequency and period
- DC and AC current

### Standard Interfaces Take the Hassle Out of Connecting to your PC

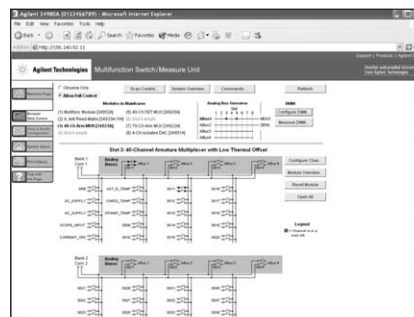
#### Standard Ethernet, USB and GPIB

Standard interfaces are included in every mainframe. Use one of the interfaces that is already available in your computer, or if you prefer, GPIB is still available.

### Remote Access and Control

The built-in Web browser interface provides remote access and control of the instrument via a Java-enabled browser such as Internet Explorer. Using the Web interface, you can set up, troubleshoot, and maintain your system remotely.

- View and modify instrument setup
- Open, close, or monitor switches
- Send SCPI commands
- Define and execute switch sequences
- View error queue
- Get status reports on relay counts



### Works With your Choice of Software

You can save time and preserve your software and hardware investments. Program directly with SCPI, or use IVI or LabVIEW software drivers that provide compatibility with the most popular development environments and tools.



## Multifunction Switch/Measure

### Mainframe and Modules 34980A (Continued)

#### Modules at a Glance

The 34980A mainframe holds up to eight plug-in modules. Mix and match them to create a custom system to meet your switching and system control needs. You can easily add or replace modules as your needs change.

Low Frequency Switch Models	Description	Max Volts	Max Current	BW (MHz)	Scan ch/sec	Thermal offset	Comments
34921A	40-channel armature multiplexer w/low thermal offset	± 300 V	1 A	45 MHz	100	<3 $\mu$ V	Temperature reference 4 current channels Config as 2- or 4-wire
34922A	70-channel armature multiplexer	± 300 V	1 A	25 MHz	100	<3 $\mu$ V	Config as 2- or 4-wire
34923A	40/80-channel reed multiplexer	± 150 V	0.5 A	45 MHz	500	<50 $\mu$ V	Config as 1-, 2- or 4-wire
34924A	70-channel reed multiplexer	± 150 V	0.5 A	25 MHz	500	<50 $\mu$ V	Config as 2- or 4-wire
34925A	40/80-channel optically isolated FET multiplexer	± 80 V	0.05 A	1 MHz	1000	<3 $\mu$ V	Config as 1-, 2- or 4-wire
34931A	Dual 4x8 armature matrix	± 300 V	1 A	30 MHz	100	<3 $\mu$ V	Backplane expandable
34932A	Dual 4x16 armature matrix	± 300 V	1 A	30 MHz	100	<50 $\mu$ V	Backplane expandable
34933A	Dual/Quad 4x8 reed matrix	± 150 V	0.5 A	30 MHz	500	<3 $\mu$ V	Backplane expandable Config as 1- or 2-wire
34937A	28-channel Form C and 4-channel Form A	300 V 250 VAC	1 A 5 A	10 MHz	N/A	<3 $\mu$ V <3 $\mu$ V	N/A N/A
34938A	20-channel 5-amp Form A	250 VAC	5 A	1 MHz	N/A	<3 $\mu$ V	N/A

RF and Microwave Models	Description	Insertion Loss	Isolation	Freq Range	VSWR	Input Impedance	Comments
34941A	Quad 1x4 50 ohm 3 GHz RF multiplexer	0.6 dB	>58 dB	3 GHz	<1.25	50 $\Omega$	@ 1 GHz
34942A	Quad 1x4 75 ohm 1.5 GHz RF multiplexer	0.6 dB	>60 dB	1.5 GHz	<1.35	75 $\Omega$	@ 1 GHz
34945A/ 34945EXT	Microwave switch/attenuator driver	Can drive up to 64 external switch coils; 32 SPDT switches, 8 multipoint switches, 8 attenuators, or your own combination. Expand with additional 34945EXTs.					
34946A	Dual 1x2 SPDT terminated microwave switch	<0.42 dB <0.69 dB	>85 dB >67 dB	4 GHz or 20 GHz	<1.15 <1.30	50 $\Omega$	@ 4 GHz @ 20 GHz
34947A	Triple 1x2 SPDT unterminated microwave switch	<0.42 dB <0.69 dB	>85 dB >67 dB	4 GHz 20 GHz	<1.15 <1.30	50 $\Omega$	@ 4 GHz @ 20 GHz

System Control Modules	Description	Specifications
34950A	64-bit digital I/O with memory and counter	Eight 8-bit digital I/O channels with programmable polarity, thresholds up to 5 V, with handshaking protocols and pattern memory. Two 10-MHz frequency counter and programmable clock output to 20 MHz.
34951A	4-channel isolated D/A converter with waveform memory	Output DC voltage up to $\pm 16$ V or DC current up to $\pm 20$ mA. Output waveforms with a 200 kHz update rate and 16 bits of resolution. Use on-board memory to create point-to-point waveforms with more than 500,000 points.
34952A	Multifunction module with 32-bit DIO, 2-ch D/A and totalizer	Four 8-bit digital I/O channels, two $\pm 12$ V analog outputs, and a 100-kHz gated totalizer.
34959A	Breadboard module	Create your own custom designs with access to the +12 V and +5 V supplies, 16 GPIO ports and 28 relay drive lines.

More detailed specifications at [www.agilent.com/find/34980A](http://www.agilent.com/find/34980A)

## Multifunction Switch/Measure

### Mainframe and Modules 34980A (Continued)

#### Accuracy Specifications<sup>1</sup>

±(% of reading + % of range)

Includes measurement error, switching error and transducer conversion error

Function	Range <sup>2</sup>	Frequency, etc.	1 Year <sup>2</sup> Tcal ± 1°C
<b>DC Voltage</b> (with 34921A/22A/ 31A/32A) <sup>10</sup>	100.0000 mV	—	0.0050 + 0.0040
	1.000000 V	—	0.0040 + 0.0007
	10.00000 V	—	0.0035 + 0.0005
	100.0000 V	—	0.0045 + 0.0006
	300.000 V	—	0.0045 + 0.0030
<b>True RMS AC Voltage<sup>3</sup></b>	100.0000 mV to 100.0000 V	3 Hz – 5 Hz	1.00 + 0.04
		5 Hz – 10 Hz	0.35 + 0.04
		10 Hz – 20 kHz	0.06 + 0.04
		20 kHz – 50 kHz	0.12 + 0.05
		50 kHz – 100 kHz	0.60 + 0.08
		100 kHz – 300 kHz <sup>5</sup>	4.00 + 0.50
	300.0000 V	3 Hz – 5 Hz	1.00 + 0.08
		5 Hz – 10 Hz	0.35 + 0.08
		10 Hz – 20 kHz	0.06 + 0.08
		20 kHz – 50 kHz	0.12 + 0.12
		50 kHz – 100 kHz	0.60 + 0.20
		100 kHz – 300 kHz <sup>6</sup>	4.00 + 1.25
<b>Resistance<sup>7</sup></b>	100.0000 Ω	1 mA	0.010 + 0.004
	1.000000 kΩ	1 mA	0.010 + 0.001
	10.00000 kΩ	100 μA	0.010 + 0.001
	100.0000 kΩ	10 μA	0.010 + 0.001
	1.000000 MΩ	5.0 μA	0.010 + 0.001
	10.00000 MΩ	500 nA	0.040 + 0.001
	100.0000 MΩ	500 nA 10 MΩ	0.800 + 0.010
<b>Frequency and Period<sup>8</sup></b>	100 mV to 300 V	3 Hz – 5 Hz	0.10
		5 Hz – 10 Hz	0.05
		10 Hz – 40 Hz	0.03
		40 Hz – 300 kHz	0.01
<b>DC Current</b> (34921A only)	10.00000 mA	<0.1 V burden	0.050 + 0.020
	100.0000 mA	<0.6 V	0.050 + 0.005
	1.000000 A	<2 V	0.100 + 0.010
<b>True RMS AC Current</b> (34921A only)	10.00000 mA and <sup>5</sup> 1.0 A	3 Hz – 5 Hz	1.00 + 0.04
		5 Hz – 10 Hz	0.30 + 0.04
		10 Hz – 5 Hz	0.10 + 0.04
	100.0000 mA <sup>9</sup>	3 Hz – 5 Hz	1.00 + 0.5
		5 Hz – 10 Hz	0.30 + 0.5
		10 Hz – 5 kHz	0.10 + 0.5

#### Temperature Measurement Accuracy ± (% of reading + % of range)

Temperature 1-Year accuracy	Type	Best Range <sup>1</sup>	
Thermocouple (34921A only, includes cold junction accuracy on terminal block)	B	1100°C to 1820°C	1.2°C
	E	-150°C to 1000°C	1.0°C
	J	-150°C to 1200°C	1.0°C
	K	-100°C to 1200°C	1.0°C
	N	-100°C to 1300°C	1.0°C
	R	300°C to 1760°C	1.2°C
	S	400°C to 1760°C	1.2°C
	T	-100°C to 400°C	1.0°C
<b>RTD</b>	R <sub>0</sub> from 49 Ω to 2.1 kΩ	-200°C to 600°C	0.06°C
<b>Thermistor</b>	2.2 k, 5 k and 10 k	-80°C to 150°C	0.08°C

<sup>1</sup> For total measurement accuracy, add temperature probe error

More detailed specifications at [www.agilent.com/find/34980A](http://www.agilent.com/find/34980A)

## Multifunction Switch/Measure

### Mainframe and Modules 34980A (Continued)

#### Operating Characteristics<sup>4</sup>

##### Single Channel Measurement Rates<sup>5</sup>

Function	Resolution <sup>7</sup>	Reading/s
<b>DCV</b>	4½ digits (0.02 plc)	3000
	5½ digits (1 plc)	59
	8½ digits (10 plc)	6
<b>2-wire Resistance</b>	4½ digits (0.02 plc)	2000
	5½ digits (1 plc)	58
	8½ digits (10 plc)	6
<b>Thermocouple</b>	(0.02 plc)	2000
	0.1°C (1 plc)	59
<b>RTD, Thermistor</b>	1°C (0.02 plc)	1900
	0.1°C (1 plc)	58
	0.01°C (10 plc)	6
<b>ACV</b>	6½ Fast (200 Hz)	350
	6½ Med (20 Hz)	350
	6½ Slow (3 Hz)	300
<b>Frequency, Period</b>	4½ digits (10 ms)	70
	5½ digits (100 ms)	9
	6½ digits (1 s gate)	1

<sup>1</sup> Reading speeds for 60 Hz: autozero OFF

<sup>2</sup> For fixed function and range, readings to memory, scaling and alarms off, autozero OFF

#### Measurement Characteristics

<b>DC Voltage</b>	Measurement Method	Continuously integrating multi-slope III A-D Converter
	A-D Linearity	0.0002% of reading + 0.0001% of range on 10 v range
	Input Resistance 100 mV, 1 V, 10 V ranges 100 V, 300 V ranges	Selectable 10 MΩ or >10.000 MΩ 10 MΩ ± 1%
	Input Bias Current	<50 pA at 25°C
	Input Protection	300 V all ranges
<b>True RMS AC Voltage</b>	Measurement Method	AC coupled True RMS – measures the AC component of the input with up to 300 Vdc of bias on any range
	Crest Factor	Maximum of 5:1 at full scale
	Additional Crest Factor Errors (non-sinewave)	Crest Factor 1–2 0.05% of reading Crest Factor 2–3 0.15% of reading Crest Factor 3–4 0.30% of reading Crest Factor 4–5 0.40% of reading
	Input Impedance	1 MΩ ± 2% in parallel with 150 pF
	Input Protection	300 Vrms all ranges
<b>Resistance</b>	Measurement Method	Selectable 4-wire or 2-wire Ohms referenced to LO input
	Offset Compensation	Selectable on 100 Ω, 1 kΩ, 10 kΩ ranges
	Maximum Lead Resistance	10% of range per lead for 100 Ω and 1 kΩ ranges 1 kΩ on all other ranges
	Input Protection	300 V on all ranges

<sup>1</sup> For 1 KΩ unbalance in LO lead

<sup>2</sup> For power line frequency 0.08%

<sup>3</sup> For power line frequency ±1% use 75 dB or ±2.5% use 60 dB

<sup>4</sup> Reading speeds for 60 Hz and (50 Hz) operation

<sup>5</sup> For fixed function and range, readings to memory, scaling and alarms off, autozero off

<sup>6</sup> Maximum limit with default settling delays defeated

<sup>7</sup> Speeds are for 4½ digits, delay 0, display off, autozero off

<sup>8</sup> Isolation voltage (ch-ch, ch-earth) 300 Vdc, AC rms

<sup>9</sup> 6½ digits = 22 bits, 5½ digits = 18 bits, 4½ digits = 15 bits

<sup>10</sup> Assumes relative time format (time since start of scan)

More detailed specifications at [www.agilent.com/find/34980A](http://www.agilent.com/find/34980A)

## Multifunction Switch/Measure

### Mainframe and Modules 34980A (Continued)

Measurement Characteristics (Continued)		
<b>Frequency and Period</b>	Measurement Method Voltage Ranges Gate Time Measurement Timeout	Reciprocal counting technique Same as AC voltage function 1 s, 100 ms, or 10 ms Selectable 3 Hz, 20 Hz, 200 Hz LF limit
<b>DC Current</b>	Shunt Resistance Input Protection	5 $\Omega$ for 10 mA, 100 mA; 0.1 $\Omega$ for 1 A 1 A 250 V fuse on 34921A module
<b>True RMS AC Current</b>	Measurement Method  Shunt Resistance Input Protection	Direct coupled to the fuse and shunt, AC coupled True RMS measurement (measures the AC component only) 5 $\Omega$ for 10 mA; 0.1 $\Omega$ for 100 mA, 1 A 1 A 250 V fuse on 34921A module
<b>Thermocouple</b>	Conversion Reference Junction Type Open Thermocouple Check	ITS-90 software compensation Internal, Fixed, or External Selectable per channel, Open >5 k $\Omega$
<b>Thermistor</b>		44004, 44007, 44006 series
<b>RTD</b>		$\alpha = 0.00385$ (DIN) and $\alpha = 0.00392$
<b>Measurement Noise Rejection 60 (50) Hz<sup>1</sup></b>	DC CMRR AC CMRR  <b>Integration Time</b> 200 plc/3.33 s (4 s) 100 plc/1.67 s (2 s) 20 plc/333 ms (400 ms) 10 plc/167 ms (200 ms) 2 plc/33.3 ms (40 ms) 1 plc/16.7 ms (20 ms) <1 plc	140 dB 70 dB  <b>Normal Mode Rejection<sup>2</sup></b> 105 dB <sup>3</sup> 100 dB <sup>3</sup> 95 dB <sup>3</sup> 90 dB 85 dB 60 dB 0 dB

<sup>1</sup> For 1 K $\Omega$  unbalance in LO lead

<sup>2</sup> For power line frequency  $\pm 0.08\%$

<sup>3</sup> For power line frequency  $\pm 1\%$  use 75 dB or  $\pm 2.5\%$  use 60 dB

<sup>4</sup> Reading speeds for 60 Hz and (50 Hz) operation

<sup>5</sup> For fixed function and range, readings to memory, scaling and alarms off, autozero off

<sup>6</sup> Maximum limit with default settling delays defeated

<sup>7</sup> Speeds are for 4  $\frac{1}{2}$  digits, delay 0, display off, autozero off

<sup>8</sup> Isolation voltage (ch-ch, ch-earth) 300 Vdc, AC rms

<sup>9</sup> 6  $\frac{1}{2}$  digits = 22 bits, 5  $\frac{1}{2}$  digits = 18 bits, 4  $\frac{1}{2}$  digits = 15 bits

<sup>10</sup> Assumes relative time format (time since start of scan)

## System Characteristics

<b>Scanning Inputs</b>	Analog  Digital	34921A -34922A, 34923A, 34924A, and 34925A multiplexer channels 34950A/52A digital in and totalize
<b>Scan Triggering</b>	Source  Scan count Scan interval Channel delay External trig delay External trig jitter	Interval, external, button press, software, or on monitor channel alarm 1 to 50,000 or continuous 0 to 99 hours; 1 ms step size 0 to 60 seconds per channel; 1 ms step size <2 ms, With monitor on <200 ms <2 ms

<sup>1</sup> Storage at temperature above 40°C will decrease battery life

<sup>2</sup> Load IO libraries version M for Windows NT Support

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More detailed specifications at [www.agilent.com/find/34980A](http://www.agilent.com/find/34980A)

## Multifunction Switch/Measure

### Mainframe and Modules 34980A (Continued)

#### Accessories

**Y1130A** Rackmount kit for 34980A, forward or reverse mount (reverse mount requires E3664A rail kit) Order E3663AC rail kit for forward rack mount

**Y1131A** Verification and diagnostic tools for 34980A mainframe and modules

**Y1132A** Module extender for 34980A

#### Cables<sup>1</sup>

(used for direct cable connection to module. Some modules require 2 cables)

**Y1135A** 1.5 m 50 pin Dsub, M/F twisted pair with outer shield cable – 300 V

**Y1136A** 3 m 50 pin Dsub, M/F twisted pair with outer shield cable – 300 V

**Y1137A** 1.5 m 78 pin Dsub, M/F twisted pair with outer shield cable – 300 V

**Y1138A** 3 m 78 pin Dsub, M/F twisted pair with outer shield cable – 300 V

#### Connector Kits<sup>1</sup>

(used to build custom cables)

**Y1139A** Solder cup connector kit for 34921/23/25/31/32/33/37/38 – 50 pin Dsub female – 125 V

**Y1140A** Solder cup connector kit for 34922/34924 – 78 pin Dsub female – 60 V

**Y1141A** Solder cup connector kit for 34951, 34952 – 50 pin Dsub male – 125 V

**Y1142A** Solder cup connector kit for the 34950A – 78 pin Dsub male – 60 V

<sup>1</sup> Module specifications include terminal block. Performance may be degraded when using cables or connector kits.

#### System Characteristics

<b>Alarms</b>	Analog inputs	Hi, Lo, or HI + Lo evaluated each scan 34950A/52A digital in maskable pattern match or state change 34950A/52A frequency and totalize, Hi limit only Alarm evaluated each reading 4 TTL compatible; selectable TTL logic Hi or Lo on fail 5 ms (typical)
	Digital inputs	
	Monitor channel	
	Alarm outputs	
	Latency	
<b>Memory</b>	Type	Volatile 500,000 with timestamp; Readable during scan 5 instrument states with user label Up to 20 events with channel number, reading, and timestamp
	Readings	
	States	
	Alarm queue	
<b>System Features</b>	Per-channel math	Individual Mx + B scaling and calculated real time
	Min/Max/Average	
	Power fail recovery	Save switch states Counts each relay closure and stores on module. User resettable.
	Relay maintenance	
	Real time clock	Battery-backed, 20 year typical life
<b>General Specifications</b>	Power supply	Universal 100 V to 240 V $\pm 10\%$ 50-60 Hz $\pm 10\%$ automatically sensed 150 VA Full accuracy 0°C to 55°C Full accuracy to 80% R.H. at 40°C IEC 60664-1 pollution degree 1 -40°C to 70°C <sup>1</sup>
	Power line frequency	
	Power consumption	133 x 426 x 341 mm (5.25" x 18.8" x 14") Full rack, 3 units high 8.6 kg (19.6 lbs) 280H x 170 W x 27D mm (11" x 6.7" x 1") Conforms to CSA, UL/IEC/EN 61010-1 Conforms to IEC/EN 61326-1, CISPR 11 1 year
	Operating environment	
	Storage environment	
	Mainframe dimensions	
	Mainframe Weight	
	Module dimensions	
	Safety	
	EMC	
	Warranty	
<b>Software</b>	Agilent connectivity software included	Agilent IO Libraries Suite 14.0 (E2884N)
	Minimum system requirements (IO) libraries and drivers	
	PC hardware	Intel Pentium 100 MHz, 84 MByte RAM 210 MByte disk space Display 800 x 600, 256 colors, CD-ROM Drive Windows® 98 SE/NT/2000/XP
	Operating System	
	Computer Interfaces	Standard LAN 10 BaseT/100 BaseTx Standard USB 2.0 IEEE400 2 GPIB
	Software driver support for programming languages	IVI-C and IVI-COM for Windows NT/2000/XP LabVIEW
	Compatible with programming tools and environments	Agilent VEE Pro, Agilent T&M Tool kit (requires Visual Studio.NET) National Instruments Test Stand, Measurement Studio, LabWindows/CVI LabVIEW, Switch Executive Microsoft Visual Studio.NET, C/C++ Visual Basic 6

<sup>1</sup> Storage at temperature above 40°C will decrease battery life

<sup>2</sup> Load IO libraries version M for Windows NT Support

## Multifunction Switch/Measure Mainframe and Modules 34980A (Continued)

### Ordering Information

**Mainframe – holds up to 8 plug-in modules 34980A Multifunction switch/measure mainframe Comes standard with “DMM” option**

#### 34945A Accessories

(distribution boards required for control of external switch)

**34945EXT** External driver for 34945A, one required for each 64 coils – holds 4 distribution boards

**Y1150A** 34945A distribution boards for 8 N181x SPDT switches

**Y1151A** 34945A distribution board for two 87104x/106x multiport or 87406B matrix switches

**Y1152A** 34945A distribution board for one 87204x/206x or 87606B switch and 2 N181x switches

**Y1153A** 34945A distribution board for two 84904/5/6/7/8 or 8494/5/6 step attenuators

**Y1154A** 34945A distribution board for two 87222 transfer switches and 6 N181x SPDT switches

**Y1155A** 34945A distribution board w/generic screw terminals for driving 16 switch coils

#### Thermocouples/Thermistors

**34307A** 10 pack of J type thermocouples

**34308A** 5 pack of 10 k thermistors

#### What Ships with a 34980A

**5061-0701** LAN Cross Over Cable

**E2094-60003** I/O Library Suite CD

**34980-906xx** Firmware Update Flyer

**8710-0059** Screwdriver

**34980-13601** Product CD Manual Set

Modules	Description	Module Connectors	Optional Terminal Blocks, Cables, Connector Kits
<b>Multiplexer Modules</b>	<b>34921A</b> 40-channel armature multiplexer w/low thermal offset (order 34921T for temp reference)	2-50 pin Dsub, Male	3492xT Terminal block with screw connectors
	<b>34923A</b> 40/80-channel reed multiplexer		Y1135A – 1.5 m 50 pin M/F Dsub cable
	<b>34925A</b> 40/80-channel optically isolated FET multiplexer		Y1136A – 3 m 50 pin M/F Dsub cable Y1139A – 50 pin female solder cup connector kit
	<b>34922A</b> 70-channel armature multiplexer	2-78 pin Dsub, Male	3492xT Terminal block with solder connectors Y1137A – 1.5 m 78 pin M/F Dsub cable
	<b>34924A</b> 70-channel reed multiplexer		Y1138A – 3 m 78 pin M/F Dsub cable Y1140A – 78 pin female solder cup connector kit
<b>Matrix Modules</b>	<b>34931A</b> Dual 4X8 armature matrix	2-50 pin Dsub, Male	3493xT Terminal block with screw connectors
	<b>34932A</b> Dual 4x16 armature matrix		Y1135A – 1.5 m 50 pin M/F Dsub cable
	<b>34933A</b> Dual/quad 4x8 reed matrix		Y1136A – 3 m 50 pin M/F Dsub cable Y1139A – 50 pin female solder cup connector kit
<b>General Purpose/Actuator Modules</b>	<b>34937A</b> 32-channel Form C/Form A General purpose switch	2-50 pin Dsub, Male	3493xT Terminal block with screw connectors Y1135A – 1.5 m 50 pin M/F Dsub cable
	<b>34938A</b> 20-channel 5-amp Form A switch		Y1136A – 3 m 50 pin M/F Dsub cable Y1139A – 50 pin female solder cup connector kit
<b>RF &amp; Microwave Modules</b>	<b>34941A</b> Quad 1x4 50-ohm 3 GHz RF multiplexer	10-SMA	Requires standard 50 ohm SMA RF cables, adapters
	<b>34942A</b> Quad 1x4 75-ohm 1.5 GHz RF multiplexer	10-Mini SMB	Requires mini 75 ohm SMB RF cables, adapters
	<b>34945A</b> Microwave switch/attenuator driver	N/A	Requires 34945EXT and optional Y1150A-Y1155A distribution boards
	<b>34946A</b> Dual 1x2 SPDT terminated microwave switch Option 004: 4 GHz switches installed Option 020: 20 GHz switches installed	SMA	Requires standard 50 ohm SMA cables and adapters
	<b>34947A</b> Triple 1x2 SPDT unterminated microwave switch Option 004: 4 GHz switches installed Option 020: 20 GHz switches installed	SMA	Requires standard 50 ohm SMA cables and adapters
<b>System Measurement &amp; Control Modules</b>	<b>34950A</b> 64-bit digital I/O with memory and counter	2-78 pin Dsub, Female	3495xT Terminal block with screw connectors Y1137A – 1.5 m 78 pin M/F Dsub cable Y1138A – 3 m 78 pin M/F Dsub cable Y1142A – 78 pin male solder cup connector kit
	<b>34951A</b> 4-channel isolated D/A converter with waveform memory (DMM option required for calibration)	1-50 pin Dsub, Female	3495xT Terminal block with screw connectors Y1135A – 1.5 m 50 pin M/F Dsub cable Y1136A – 3 m 50 pin M/F Dsub cable Y1141A – 50 pin female solder cup connector kit
	<b>34952A</b> Multifunction module with 32-bit DIO, 2-ch D/A and totalizer		
	<b>34959A</b> Breadboard module	26 & 40 pin internal ribbon cable connections	Any terminal block can be used assuming 50 or 78 pin Dsub is used

More detailed specifications at [www.agilent.com/find/34980A](http://www.agilent.com/find/34980A)

# Digital Multimeters, Voltmeters

Product Comparison	34401A	3458A	34970A w/ 34901A	34420A	
Type	DMM 6 1/2 Digit	DMM 8 1/2 Digit	Data Logger/ Scanning DMM 6 1/2 Digit	Nanovolt / micro-ohm meter 7 1/2 Digit	
Basic Measurements	DC & AC voltage, DC & AC current, 2 & 4 wire resistance, frequency & period			DC voltage, 2 & 4 wire resistance, low power resistance, ratio	
Additional Measurements	continuity, diode test	3 modes of true RMS, Digitizing	Scanning 20 to 60 2-wire channels	2 channels - ratio and difference	
Temperature	N/A	Thermistor, RTD	Thermocouple, RTD, Thermistor	Direct SPRT, RTD, Thermistor, Thermocouple	
dcV Accuracy <sup>1</sup> ±(% of reading + % of range)	0.0035 + 0.0005	0.0008 + 0.000005 (.0004 + .000005) <sup>2</sup>	0.0035 + 0.0005	0.003 + 0.0004	
Math Functions	Null, statistics, dBm, dB, limit test	Null, statistics, dBm, dB, limit test, scale, offset, filter, % error	Null, statistics, limit test, scale, offset	Null, statistics, dBm, dB, limit, test, scale, offset, filter, moving avg. filter	
Connectivity	GPIB, RS232, Optional USB w/82357A  Includes Intuilink SW	GPIB, Optional USB w/ 82357A	GPIB, RS232, Optional USB w/82357A  Includes BenchLink Data Logger SW	GPIB, RS232, Optional USB w/82357A  Includes Intuilink SW	

<sup>1</sup> dcV accuracy; 1yr, 10 V range

<sup>2</sup> dcV accuracy with optional high stability reference (option 3458-002)



34401A

## Low-Cost 6½ Digit Multimeter 34401A

12 measurement functions

1000 V maximum input

35 ppm basic dcV accuracy (1-year)

1000 readings per second direct to GPIB

GPIB and RS-232 standard

512-reading memory

3 Hz to 300 kHz AC bandwidth

IntuiLink Connectivity Software included

### 34401A Digital Multimeter

The 34401A digital multimeter establishes a new price/performance standard by offering such features as 6½ digits of resolution, 1000 readings per second, and 15 ppm basic DC accuracy at a surprisingly affordable price. The 34401A has been designed for superior performance while providing the flexibility to meet both your present and future needs.

### Great Bench Performance

The clear, logical front panel of the 34401A allows you to easily select all primary measurement functions. Traditional “bench” functions, such as continuity and diode test, are included. Math functions, such as NULL, dB, dBm, limit test, and min/max/avg are easily selected. A simple menu scheme gives you access to powerful advanced features, such as the ability to store up to 512 readings in internal memory. Measurement results are displayed on a bright, high-visibility readout. A rugged case ensures survival even under the toughest conditions, and the optional accessory pouch makes it easy to pack up and go with the 34401A.

### Superior Performance in Your System

The 34401A can take up to 1000 readings per second, including GPIB bus transfer in ASCII format. Both GPIB and RS-232 are standard, letting you select the interface that best meets your needs. 34401A responds to three different command languages. It accepts SCPI commands (Standard Commands for Programmable Instruments), which ensures present and future compatibility. Drivers are also available for both National Instruments Labview and Agilent’s VEE software.

IntuiLink Software, included with your 34401A, allows you to transfer your measurement data and images into Microsoft Excel or Microsoft Word with little or no programming. You can specify the meter setup and take a single reading or log data to the Excel spreadsheet in specific time intervals. Programmers can use the ActiveX components to control the DMM using SCPI commands. To find out more about IntuiLink, visit [www.agilent.com/find/intuilink](http://www.agilent.com/find/intuilink)

### Application Information

**Optimizing System Design for Rapid Development, Fast Execution and Re-use**  
Application Note 1481  
5989-0154EN

**Techniques to Minimize Overall Test Time When Using a DMM and Switch System**  
Application Note 1479  
5989-0150EN

**Making High Accuracy Temperature Measurements with the 3499A/B/C Switch and the 34401A Digital Multimeter**  
Application Note 1460  
5988-9550EN

**Digital Multimeter Measurement Errors Series System Cabling Errors and DC Voltage Measurement Errors in Digital Multimeters**  
Application Note AN 1389-1  
5988-5511EN

**Digital Multimeter Measurement Errors Series Resistance; DC Current; AC Current; and Frequency and Period Measurement Errors in Digital Multimeters**  
Application Note AN 1389-2  
5988-5512EN



## Low-Cost 6½ Digit Multimeter 34401A (Continued)

Low Cost 6½ Digital Multimeter  
– Abbreviated Technical Specifications

## General Specifications:

**Power:** 100/120/220/240V,  $\pm 10\%$ **Power Line Frequency:**

45 to 66 Hz, 360 to 440 Hz

**Power Consumption:** 25 VA peak  
(10 W average)**Operating Environment:** 0 to 55°C,  
full accuracy to 80% RH, 40°C**Storage Environment:** -40°C to 70°C**Size:** 88.5 mm H x 212.6 mm W  
x 348.3 mm D (4 in x 8.5 in x 14 in)**Weight:** Net 3.6 kg (8.0 lb);  
shipping 5.9 kg (13 lb)**Safety:** Designed to UL-1244,  
IEC-348, CSA

## Order Information:

**34401A** Multimeter**34401A-1CM** Rackmount Kit**34401A-A6J** ANSI Z540

Compliant Calibration

**34161A** Accessory Pouch**34171A** Input Terminal Connector  
(sold in pairs)**34172A** Input Calibration Short  
(sold in pairs)**34131A** Hard Transit Case

## DC Voltage Input Characteristics

Range	Maximum Reading (6½ digits)	Resolution in Digits			Input Resistance
		6½	5½	4½	
100 mV	120.0000	100 µV	1 µV	10 µV	10 MΩ or >10 GΩ
1 V	1.200006	1 µV	10 µV	100 µV	10 MΩ or >10 GΩ
10 V	12.00000	10 µV	100 µV	1 mV	10 MΩ or >10 GΩ
100 V	120.0000	100 µV	1 mV	10 mV	10 MΩ
1000 V	1050.000	1 mV	10 mV	100 mV	10 MΩ

**Input Protection:** >1000 V on all rangesMeasurement Accuracy:  $\pm$ (% of reading + % of range)

Range	24 Hour 23°C $\pm$ 1°C	90 Day 23°C $\pm$ 1°C	1 Year 23°C $\pm$ 1°C
100 mV	0.0030 + 0.0030	0.0040 + 0.0035	0.0050 + 0.0035
1 V	0.0020 + 0.0006	0.0030 + 0.0007	0.0040 + 0.0007
10 V	0.0015 + 0.0004	0.0020 + 0.0005	0.0035 + 0.0005
100 V	0.0020 + 0.0006	0.0035 + 0.0006	0.0045 + 0.0006
1000 V	0.0020 + 0.0006	0.0035 + 0.0010	0.0045 + 0.0010

## Maximum Reading Rate: (readings/s)

Power Line Frequency	Resolution in Digits		
	6½	5½	4½
60 Hz	6	300	1000
50 Hz	6	300	1000

AC Voltage (true rms) Measurement Accuracy:  $\pm$ (% of reading + % of range); 1 year, 23°C + 5°C

Frequency	Ranges 100 mV	Ranges 1, 10, 100, 750 V
3 to 5 Hz	1.00 + 0.04	1.00 + 0.03
5 to 10 Hz	0.35 + 0.04	0.35 + 0.03
10 Hz to 20 kHz	0.06 + 0.04	0.06 + 0.03
20 to 50 kHz	0.12 + 0.04	0.12 + 0.05
50 to 100 kHz	0.60 + 0.08	0.60 + 0.08
100 to 300 kHz*	4.00 + 0.50	4.00 + 0.50

\*Typically 30% of reading error at 1 MHz

## Low-Cost 6½ Digit Multimeter 34401A (Continued)

### Low Cost 6½ Digit Multimeter – Abbreviated Technical Specifications (Continued)

#### Resistance: (2-wire $\Omega$ , 4-wire $\Omega$ ) Input Characteristics

Range	Maximum Reading (6½ digits)	Resolution in Digits		
		6½	5½	4½
100 $\Omega$	120.0000	100 $\mu\Omega$	1 m $\Omega$	10 m $\Omega$
1 k $\Omega$	1.200000	1 m $\Omega$	10 m $\Omega$	100 m $\Omega$
10 k $\Omega$	12.00000	10 m $\Omega$	100 m $\Omega$	1 $\Omega$
100 k $\Omega$	120.0000	100 m $\Omega$	1 $\Omega$	10 $\Omega$
1 M $\Omega$	1.200000	1 $\mu$	10 $\Omega$	100 $\Omega$
10 M $\Omega$	12.00000	10 $\mu$	100 $\Omega$	1 k $\Omega$
100 M $\Omega$	120.0000	100 $\mu$	1 k $\Omega$	10 $\Omega$

**Input Protection:** >1000 V on all ranges

#### Measurement Accuracy: $\pm$ (% of reading + % of range) Specs are for 4-wire $\Omega$ or 2-wire $\Omega$ using Math Null

Range	24-Hour 23°C $\pm$ 1°C	90-Day 23°C $\pm$ 5°C	1-Year 23°C $\pm$ 5°C	Shunt Resistance
100 $\Omega$	0.0030 + 0.0030	0.008 + 0.004	0.010 + 0.004	1 mA
1 k $\Omega$	0.0020 + 0.0005	0.008 + 0.001	0.010 + 0.001	1 mA
10 k $\Omega$	0.0020 + 0.0005	0.008 + 0.001	0.010 + 0.001	100 $\mu$ A
100 k $\Omega$	0.0020 + 0.0005	0.008 + 0.001	0.010 + 0.001	10 $\mu$ A
1 M $\Omega$	0.0020 + 0.001	0.008 + 0.001	0.010 + 0.001	5.0 $\mu$ A
10 M $\Omega$	0.0150 + 0.001	0.020 + 0.001	0.040 + 0.001	500 nA
100 M $\Omega$	0.3000 + 0.010	0.800 + 0.010	0.800 + 0.010	500 nA*

**Maximum Reading Rate:** Same as dcV

#### DC Current Measurement Accuracy: $\pm$ (% of reading + % of range)

Range	24-Hour 23°C $\pm$ 1°C	90-Day 23°C $\pm$ 5°C	1-Year 23°C $\pm$ 5°C	Shunt Resistance
10 mA	0.005 + 0.010	0.030 + 0.020	0.050 + 0.020	500 $\Omega$
100 mA	0.010 + 0.004	0.030 + 0.005	0.050 + 0.005	5.0 $\Omega$
1 A	0.050 + 0.006	0.080 + 0.010	0.100 + 0.010	0.1 $\Omega$
3 A	0.100 + 0.020	0.120 + 0.020	0.120 + 0.020	0.1 $\Omega$

**Input Protection:** Externally accessible 3 A 250 V fuse; internal 7 A 500 V fuse

**Maximum Reading Rate:** Same as dcV

#### AC Current (true rms): Measurement Accuracy: $\pm$ (% of reading + % range); 1 year, 23°C $\pm$ 5°C

Frequency	Ranges 1 A	Ranges 3 A
3 to 5 Hz	1.00 + 0.04	1.10 + 0.06
5 to 10 Hz	0.30 + 0.04	0.35 + 0.06
10 Hz to 5 kHz	0.10 + 0.04	0.15 + 0.06

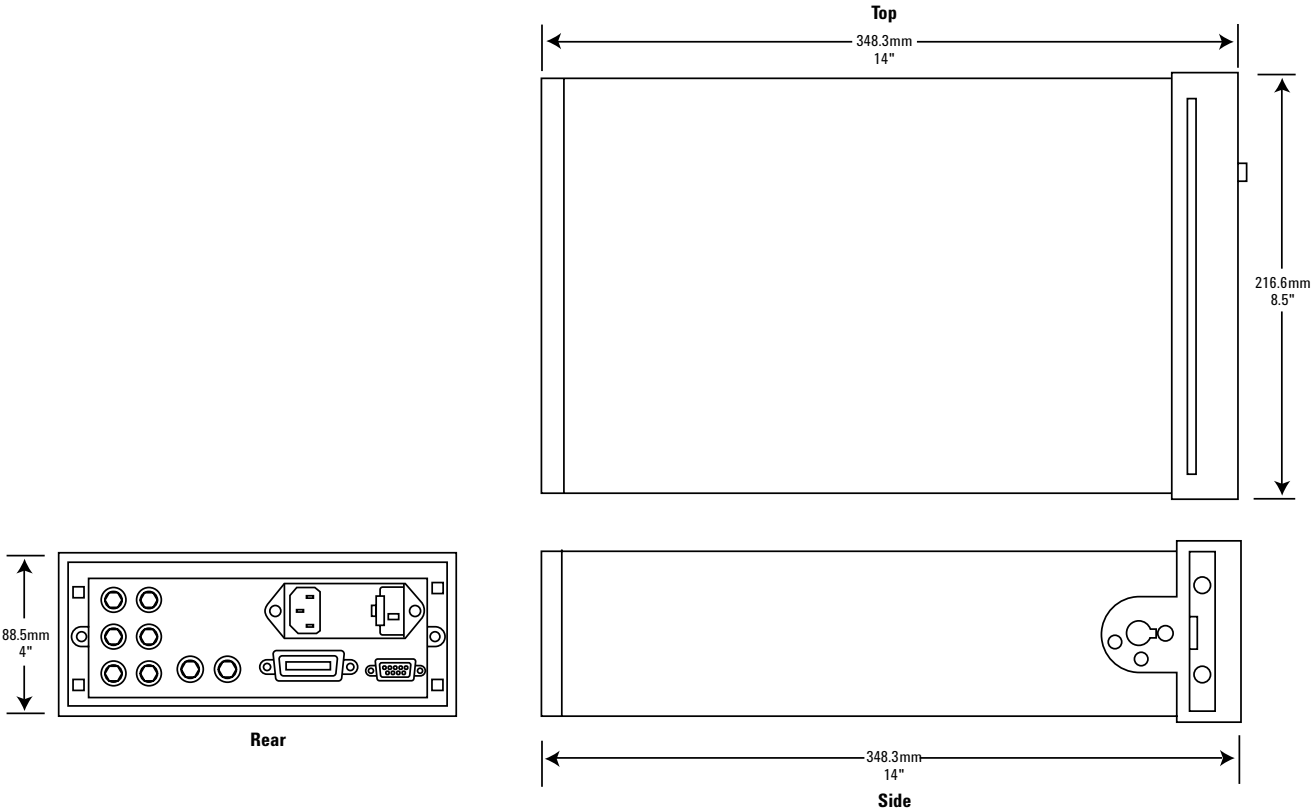
**Input Protection:** Externally accessible 3 A 250 V fuse; internal 7 A 500 V fuse

**Maximum Reading Rate:** Same as dcV

More detailed specifications at [www.agilent.com/find/34401A](http://www.agilent.com/find/34401A)

Low-Cost 6½ Digit Multimeter 34401A (Continued)

Agilent Model: 34401A



# 8½ Digit Multimeter 3458A



3458A

8½ digit resolution  
100,000 reading/s (4½ digits)  
8 ppm (4 ppm optional) voltage stability – 1 year  
To 1000 V input range

## Abbreviated Technical Specifications

### 3458A Multimeter

The Agilent 3458A multimeter shatters long-standing performance

barriers of speed and accuracy on the production test floor, in research and development, and in the calibration lab. The 3458A is the fastest, most flexible, and most accurate multimeter offered by Agilent Technologies. In your system or on the bench, the 3458A saves you time and money with unprecedented test-system throughput and accuracy, seven-function measurement flexibility, and low cost of ownership.

Select a rate of 100,000 reading per second for maximal test throughput. Or achieve highest levels of precision with up to 81.2 digits of measurement resolution and 0.1 part per million transfer accuracy. Add to this the 3458A's simplicity of operation, and you have the ideal multimeter for your most demanding applications.

### High-Test System Throughput Faster Testing

- Up to 100,000 readings/s
- Internal test setups >340/s
- Programmable integration times from 500 ns to 1 s

### Greater Test Yield

- More accuracy for tighter test margins
- Up to 8½ digits resolution

### Longer Uptime

- Two-source (10 V, 10 kΩ) calibration, including AC
- Self-adjusting, self-verifying auto-calibration for all functions and ranges, including AC

### High-Resolution Digitizing

#### Greater Waveform Resolution and Accuracy

- 16 to 24-bits resolution
- 100,000 to 0.2 sample/s
- 12 MHz bandwidth
- Timing resolution to 10 ns
- Less than 100 ps time jitter
- Over 75,000 reading internal memory

### Calibration Lab Precision

#### Superb Transfer Measurements

- 8½ digits resolution
- 0.1 ppm DC volts linearity
- 0.1 ppm DC volts transfer capability
- 0.01 ppm rms internal noise

### Extraordinary Accuracy

- 0.6 ppm for 24 hours in DC volts
- 2.2 ppm for 24 hours in Ω
- 100 ppm mid-band AC volts
- 8 ppm (4 ppm optional) per year voltage reference stability

### 3458A Multimeter Performance Features

#### DC Volts

- 5 ranges: 0.1 V to 1000 V
- 8½ to 4½ digits resolution
- Up to 100,000 readings/s (4½ digits)
- Maximum sensitivity: 10 nV
- 0.6 ppm 24-hour accuracy
- 8 ppm (4 ppm optional)/year voltage reference stability

#### Resistance

- 9 ranges: 10 Ω to 1 GΩ
- 2-wire and 4-wire Ω with offset compensation
- Up to 50,000 readings/second (5½ digits)
- Maximum sensitivity: 10 μΩ
- 2.2 ppm 24-hour accuracy

#### AC Volts

- 6 ranges: 10 mV to 1000 V
- 1 Hz to 10 MHz bandwidth
- Up to 50 readings/s with all readings to specified accuracy
- Choice of sampling or analog true rms techniques
- 100 ppm best accuracy

## 8½ Digit Multimeter 3458A (Continued)

## Abbreviated Technical Specifications

## DC Current

- 8 ranges: 100 nA to 1 A
- Up to 1,350 readings/s (5½ digits)
- Maximum sensitivity: 1 pA
- 14 ppm 24-hour accuracy

## AC Current

- 5 ranges: 100 µA to 1 A
- 10 Hz to 100 kHz bandwidth
- Up to 50 readings/second
- 500 ppm 24-hour accuracy

## Frequency and Period

- Voltage or current ranges
- Frequency: 1 Hz to 10 MHz
- Period: 100 ns to 1 second
- 0.01% accuracy
- AC or DC coupled

## Throughput

## Maximum Reading Rates

- 100,000 readings/s at 4½ digits (16 bits)
- 50,000 readings/s at 5½ digits
- 6,000 readings/s at 6½ digits
- 60 readings/s at 7½ digits
- 6 readings/s at 8½ digits

## Measurement System Speed

- 100,000 readings/s over GPIB or with internal memory
- 110 autoranges/s
- 340 function or range changes/s
- Postprocessed math from internal memory

## Math Functions

The 3458A performs the following math functions on measurements: null, scale, offset, rms filter, single pole filter, thermistor linearization, db, dbm, % error, pass/fail LIMIT TESTING, and statistics. Two math functions may be used at one time.

## DC Voltage

Range	Full Scale	Maximum Resolution	1-Year* Accuracy ppm of reading + ppm of range	Transfer Accuracy 10 min., tref ±0.5°C	Input Impedance
100 mV	120.00000	10 nV	9(5) + 3	0.5 + 0.5	>10 GΩ
1 V	1.2000000	10 nV	8(4) + 0.3	0.3 + 0.1	>10 GΩ
10 V	12.000000	100 nV	8(4) + 0.05	0.05 + 0.05	>10 GΩ
100 V	120.00000	1 µV	10(6) + 0.3	0.5 + 0.1	10 MΩ ± 1%
1000 V	1050.0000	10 µV	10(6) + 0.1	1.5 + 0.05	10 MΩ ± 1%

One-year specifications for NPLC 100 within 24 hours and ±1°C of last ACAL, Tcal ±5°C, MATH NULL, fixed range. Add 2 ppm of reading additional error for Agilent factory traceability of 10 V DC to US NIST. Traceability error is the absolute error relative to National Standards associated with the source of last external calibration. Transfer specifications for NPLC 100, following 4-hour warm-up. Full scale to 10% of full scale. Measurements on the 1000 V range are within 5% of the initial measurement value and following measurement settling. Tref is the starting ambient temperature. Measurements are made on a fixed range using accepted metrology practices. \*High stability (Option 002) ppm of reading in parentheses.

Noise Rejection (dB)<sup>1</sup>

	AC NMR <sup>2</sup>	AC ECMR	DC ECMR
NPLC <1	0	90	140
NPLC ≥ 1	60	150	140
NPLC ≥ 10	60	150	140
NPLC ≥ 100	60	160	140
NPLC = 1000	75	170	140

<sup>1</sup> Applies for 1 kΩ unbalance in the LO lead and ±0.1% of the line frequency currently set for LFREQ.

<sup>2</sup> For line frequency ±1%, ACNMR is 40 dB for NPLC ≥1, or 55 dB for NPLC ≥100.  
For line frequency ±5%, ACNMR is 30 dB for NPLC ≥100.

## DC Maximum Input

	Rated Input	Nondestructive
HI to LO	±1000 V pk	±1200 V pk
LO to guard	±200 V pk	±300 V pk
Guard to earth	±500 V pk	±1000 V pk

## Abbreviated Technical Specifications (Continued)

## Application Information:

## Notes Digital Multimeter Measurement Errors Series System Cabling Errors and DC Voltage Measurement Errors in Digital Multimeters

Application Note AN 1389-1  
5988-5511EN

## Digital Multimeter Measurement Errors Series Resistance; DC Current; AC Current; and Frequency and Period Measurement Errors in Digital Multimeters.

Application Note AN 1389-2  
5988-5512EN

## Digital Multimeter Measurement Errors Series AC Voltage Measurement Errors in Digital Multimeters

Application Note AN 1389-3  
5988-5513EN

## General Specifications

Operating Temperature: 0°C to 55°C

Warmup Time: Four hours to all specifications except where noted

Humidity Range:  
95% RH, 0°C to 40°CStorage Temperature:  
–40°C to +75°CPower: 100/120 V, 220/240 V  $\pm$  10%,  
48 to 66 Hz, 360 to 420 Hz automatically  
sensed. Fused at 1.5 A @115 V or  
0.5 A @230 V. <30 W, < 80 VA (peak).Size: 88.9 mm H x 425.5 mm W x  
502.9 mm D (3.5 in x 16.75 in x 19.8 in)Weight: Net, 12 kg (26.5 lb);  
shipping, 14.8 kg (32.5 lb)

## Ordering Information

3458A Multimeter (with GPIB, 20 KB  
reading memory, and 8 ppm stability)3458A-001 Extended Reading Memory  
(expands total to 148 KB)3458A-002 High-Stability  
(4 ppm/year) Reference3458A-A6J ANSI Z540  
Compliant Calibration

3458A-907 Front-handle Kit

3458A-908 Rack Flange Kit

3458A-909 Rack Flange Kit  
(with handles)

## 8½ Digit Multimeter 3458A (Continued)

## True rms AC Voltage (Synchronous Subsampled Mode)

Range	Full Scale	Maximum Resolution	Accuracy* 24 Hour – 2 Year 40 Hz to 1 kHz % of reading + % of range	Input Impedance
10 mV	12.00000	10 nV	0.02 + 0.011	1 M $\Omega$ $\pm$ 15% with <140 pF
100 mV	120.00000	10 nV	0.007 + 0.002	1 M $\Omega$ $\pm$ 15% with <140 pF
1 V	1.2000000	100 nV	0.007 + 0.002	1 M $\Omega$ $\pm$ 15% with <140 pF
10 V	12.000000	1 $\mu$ V	0.007 + 0.002	1 M $\Omega$ $\pm$ 2% with <140 pF
100 V	120.00000	10 $\mu$ V	0.02 + 0.002	1 M $\Omega$ $\pm$ 2% with <140 pF
1000 V	700.0000	100 $\mu$ V	0.04 + 0.002	1 M $\Omega$ $\pm$ 2% with <140 pF

\* Specifications apply for full scale to 10% of full scale, DC <10% of AC, sine-wave input, crest factor of 1.4. Within 24 hours and  $\pm$ 1°C of last ACAL. Peak (AC+DC) input limited to 5 x full scale for all ranges. Add 2 ppm of reading additional error for Agilent factory traceability of 10 Vdc to US NIST.

## AC Maximum Input

	Rated Input	Nondestructive
HI to LO	$\pm$ 1000 V pk	$\pm$ 1200 V pk
LO to guard	$\pm$ 200 V pk	$\pm$ 350 V pk
Guard to earth	$\pm$ 500 V pk	$\pm$ 1000 V pk
Volt-Hz product	1 x 10*	-

## Resistance

Range	Full Scale	Maximum Resolution	Current Source	1-Year Accuracy* (4-wire $\Omega$ ) ppm of rdg+ppm of range
10 $\Omega$	12.00000	10 $\mu\Omega$	10 mA	15 + 5
100 $\Omega$	120.00000	10 $\mu\Omega$	1 mA	12 + 5
1 k $\Omega$	1.2000000	100 $\mu\Omega$	1 mA	10 + 0.5
10 k $\Omega$	12.000000	1 m $\Omega$	100 $\mu$ A	10 + 0.5
100 k $\Omega$	120.00000	10 m $\Omega$	50 $\mu$ A	10 + 0.5
1 M $\Omega$	1.2000000	100 m $\Omega$	5 $\mu$ A	15 + 2
10 M $\Omega$	12.000000	1 $\Omega$	500 nA	50 + 10
100 M $\Omega$	120.00000	10 $\Omega$	500 nA	500 + 10
1 G $\Omega$	1.2000000	100 $\Omega$	500 nA	0.5% + 10

## Memory

	Standard Readings	Bytes	Option 001 Readings	Bytes
Reading Storage (16 bit)	10,240	20 k	+65,536	+128 k
Non-volatile, for Subprograms and/or State Storage	—	14 k	—	—

More detailed specifications at [www.agilent.com/find/multimeters](http://www.agilent.com/find/multimeters)



34420A

## Nanovolt/Micro-ohm Meter 34420A

7½ digit resolution

1.3 nV rms noise/8 nVp-p

100 pV, 100 nΩ sensitivity

Two-channel programmable voltage input;  
difference and ratio functions

1 mV to 100 V ranges

SCPI and Keithley 181 languages

Direct SPRT, RTD, Thermistor, and thermocouple  
temperature measurements

IntuiLink Connectivity Software included

### 34420A Nanovolt/Micro-ohm Meter

The Agilent 34420A sets a price/performance standard in low-level measurement capability. The noise performance of the 34420A nanovolt/micro-ohm meter is more than an order of magnitude better than that previously available from Hewlett-Packard.

#### Accurate, Repeatable Low-Level Measurements

A shielded copper pin screw-down connector, a 7½ digit A/D converter 2 ppm basic DC accuracy, and a new measurement algorithm that gives 100 dB normal mode rejection without front-end filtering result in measurement capability you can depend on to make accurate and repeatable low-level measurements. Low noise input amplifiers and a highly-tuned input protection scheme bring reading noise down to 8 nVp-p. Longer integration times improve noise performance even further.

#### Math Functions Enhance Capabilities

Math functions such as NULL, STATS, and SCALE ease the capture of minimum and maximum readings, provide averages and standard

deviation, scale your measurement results, and ultimately makes it easier for you to characterize your input signal. The 34420A can also store up to 1024 readings in internal memory.

#### Agilent IntuiLink: Easy Data Access

The Included Agilent IntuiLink software allows your captured data to be put to work easily, using PC applications such as Microsoft Excel or Microsoft Word, to analyze, interpret, display, print, and document the data you get from the 34420A. To find out more about IntuiLink, visit [www.agilent.com/find/intuilink](http://www.agilent.com/find/intuilink)

#### Unprecedented Functionality

Two input channels allow voltage measurements to be made independently, or they can be mathematically combined to make difference and ratio measurements. Ohms measurements combine the low-noise input circuits with a highly-stable current source to provide outstanding low-resistance measurements. Offset compensation is employed to eliminate the effects of stray thermal EMFs that would otherwise result in measurement

error. Low power ohms and a low-voltage resistance measurement capability allow repeatable measurements to be made where a low voltage (20 mV) is required to avoid oxidation punch-through. A wide range of temperature measurement capabilities are also built in, providing support for SPRT, thermocouple, RTD, and thermistor temperature sensors.

#### Built-in Versatility

You will find that the 34420A will fit equally well into your bench or your system applications. Designed with the bench user in mind, operation of the 34420A from the front panel is straightforward and intuitive. For system applications, the 34420A includes both GPIB and RS-232 interfaces standard, and uses Standard Commands for Programmable Instrumentation (SCPI). This ensures both present and future compatibility. The 34420A also responds to commands for the Keithley 181 nanovoltmeter.

## Nanovolt/Micro-ohm Meter 34420A (Continued)

### Abbreviated Technical Specifications

**Accuracy Specifications:**  
± (% of reading + % of range)

#### Temperature

**SPRT:** ITS-90 calibrated temperature within the range of -190° to +660°C

**RTD:** Type A = 0.00385 and A = 0.00392. R<sub>0</sub> from 4.9 Ω to 2.1 KΩ. ITS-90 (IEC 751) Callendar-Van Dusen conversion

**Thermistor:** 5 KΩ

**Thermocouple:** ITS-90 conversions of type B, E, J, K, N, R, S, T

#### Chart Out (Analog Out)

**Resolution:** 16 bits

**Maximum Output:** ±3 V

**Span and Offset:** Adjustable

#### Filter (Analog or Digital or Both)

**Analog:** Low pass 2 pole @13 Hz, available for dcV on 1 mV, 10 mV, 100 mV ranges

**Digital:** Moving average filter. 10 (fast), 50 (medium) or 100 (slow) reading averages

#### Math Functions

**NULL** (Channel 1 dcV, Channel 2 dcV, Difference, Resistance, Temperature)

**STATS** (Min/max/avg, peak-peak, standard deviation, number of readings)

**SCALE** (Allows linear scaling as Y=MX + B)

**CHART NULL** (Establishes zero for rear-panel output)

### Application Information

**Digital Multimeter Measurement Errors Series System Cabling Errors and DC Voltage Measurement Errors in Digital Multimeters**  
Application Note AN 1389-1  
5988-5511EN

**Digital Multimeter Measurement Errors Series Resistance; DC Current; AC Current; and Frequency and Period Measurement Errors in Digital Multimeters.**  
Application Note AN 1389-2  
5988-5512EN

### DC Voltage<sup>1</sup> – 7½ digits Resolution all Ranges

Range	24-Hour 23°C ± 1°C	90-Day 23°C ± 5°C	1-Year 23°C ± 5°C
1 mV	0.0025 + 0.0020	0.0040 + 0.0020	0.0050 + 0.0020
10 mV	0.0025 + 0.0002	0.0040 + 0.0002	0.0050 + 0.0003
100 mV	0.0015 + 0.0003	0.0030 + 0.0004	0.0040 + 0.0004
1 V	0.0010 + 0.0003	0.0025 + 0.0004	0.0035 + 0.0004
10 V	0.0002 + 0.0001	0.0020 + 0.0004	0.0030 + 0.0004
100 V	0.0010 + 0.0004	0.0025 + 0.0005	0.0035 + 0.0005

**DCV1/DCV2 (ratio):** Ratio error in % = channel 1 accuracy in % + channel 2 accuracy in %

**DCV1-2 (difference):** Difference error = channel 1 (% reading + % range) + channel 2 (% reading + % range)

### DC Voltage Noise Specifications<sup>2</sup>

Range	2-Minute rms Noise	2 – Minute p-p Noise	24-Hour p-p Noise
1 mV	1.3 nV RMS	8 nV p-p	12 nV p-p
10 mV	1.5 nV RMS	10 nV p-p	14 nV p-p
100 mV	10 nV RMS	65 nV p-p	80 nV p-p
1 V	100 nV RMS	650 nV p-p	800 nV p-p
10 V	450 nV RMS	3 μV p-p	3.7 μV p-p
100 V	11 μV RMS	75 μV p-p	90 μV p-p

**DC Voltage:** **Input Resistance:** 10 MΩ ± 1% (100 V range)  
>10 GΩ ± (1 mV through 10 V range)

**Input Protection:** 150 V peak to Channel 1 LO

### Resistance<sup>3</sup> – 7½ digits Resolution all Ranges

Range	Test Current	24-Hour 23°C ± 1°C	90-Day 23°C ± 5°C	1-Year 23°C ± 5°C
1 Ω	10 mA	0.0015 + 0.0002	0.0050 + 0.0002	0.0070 + 0.0002
10 Ω	10 mA	0.0015 + 0.0002	0.0040 + 0.0002	0.0060 + 0.0002
100 Ω	10 mA	0.0015 + 0.0002	0.0040 + 0.0002	0.0060 + 0.0002
1 kΩ	1 mA	0.0015 + 0.0002	0.0040 + 0.0002	0.0060 + 0.0002
10 kΩ	100 μA	0.0015 + 0.0002	0.0040 + 0.0002	0.0060 + 0.0002
100 kΩ	10 μA	0.0015 + 0.0003	0.0040 + 0.0004	0.0060 + 0.0004
1 MΩ	5 μA	0.0015 + 0.0003	0.0050 + 0.0004	0.0070 + 0.0004

<sup>1</sup> Specifications are for channel 1 or channel 2 (100 V range on channel 1 only), after 2-hour warm-up, resolution at 7.5 digits (100 NPLC), with filters off.

<sup>2</sup> After a 2-hour warm-up ±1°C, 6.5 digits (10 NPLC) with analog filter off digital filter medium (50 readings). 2 minute rms and 24-hour noise typical.

<sup>3</sup> All resistance specifications are for channel 1 only, after 2-hour warm-up, resolution at 7.5 digits (100 NPLC) with filters off, for 4-wire Ω or 2-wire Ω using Null.

<sup>4</sup> For 25 Ω SPRT with triple-point of water check within last 4 hours. With no triple-point of water check, add 0.013°C for 24-hour, 0.035°C for 90-day, and 0.055°C for 1-year specifications.

<sup>5</sup> For fixed reference junction. Add 0.3°C for external reference junction, add 2.0°C for internal reference junction.



## Nanovolt/Micro-ohm Meter 34420A (Continued)

### Abbreviated Technical Specifications

**Accuracy Specifications:**  
± (% of reading + % of range)

### General Specifications

**Front-Panel Connection:** Shielded, low-thermal, copper contacts

**Interface:** GPIB and RS-232 standard

**Languages:** SCPI-1994 (IEEE-488.2), Keithley 181

### Ordering Information

**34420A** Nanovolt/Micro-Ohm Meter  
Includes low-thermal input cable (34102A), low-thermal shorting plug (34103A), operating and service manuals, quick reference guide, test report with calibration sticker, 2.3 ml bottle of contact cleaner, and power cord.

**34420A-1CM** Rackmount Kit

**34420A-A6J** ANSI Z540  
Compliant Calibration

### Accessories

**34102A** Low-Thermal Input Cable (four-conductor with copper spade lugs)

**34103A** Low-Thermal Shorting Plug

**34104A** Low-Thermal Input Connector

**34161A** Accessory Pouch

**34131A** Hard Transit Case

### Low Power Resistance<sup>3</sup> – 7<sup>1</sup>/<sub>2</sub> digits Resolution all Ranges

Range	Test Current	24-Hour 23°C ± 1°C	90-Day 23°C ± 5°C	1-Year 23°C ± 5°C
1 Ω	10 mA	0.0015 + 0.0002	0.0050 + 0.0002	0.0070 + 0.0002
10 Ω	10 mA	0.0015 + 0.0002	0.0040 + 0.0002	0.0060 + 0.0002
100 Ω	1 mA	0.0015 + 0.0002	0.0040 + 0.0002	0.0060 + 0.0002
1 kΩ	100 μA	0.0015 + 0.0002	0.0040 + 0.0002	0.0060 + 0.0002
10 kΩ	10 μA	0.0015 + 0.0004	0.0040 + 0.0004	0.0060 + 0.0004
100 kΩ	5 μA	0.0015 + 0.0012	0.0040 + 0.0015	0.0060 + 0.0015
1 MΩ	5 μA	0.0020 + 0.0003	0.0050 + 0.0004	0.0070 + 0.0004

### Voltage Limited Resistance<sup>3</sup>: Voltage limit selectable: 20 mV, 100 mV, or 500 mV

Range	Test Current	24-Hour 23°C ± 1°C	90-Day 23°C ± 5°C	1-Year 23°C ± 5°C
10 Ω	1 mA	0.0020 + 0.0002	0.0050 + 0.0002	0.0070 + 0.0002
100 Ω	100 μA	0.0025 + 0.0002	0.0040 + 0.0002	0.0070 + 0.0002

### Temperature: 0.001°C Resolution

Probe Type	Accuracy
SPRT <sup>4</sup>	SPRT probe accuracy +0.003°C
RTD	RTD probe accuracy +0.05°C
Thermistor	Thermistor probe accuracy +0.1°C
Thermocouple <sup>5</sup>	Thermocouple probe accuracy +0.2°C

<sup>1</sup> Specifications are for channel 1 or channel 2 (100 V range on channel 1 only), after 2-hour warm-up, resolution at 7.5 digits (100 NPLC), with filters off.

<sup>2</sup> After a 2-hour warm-up ±1°C, 6.5 digits (10 NPLC) with analog filter off digital filter medium (50 readings). 2 minute rms and 24-hour noise typical.

<sup>3</sup> All resistance specifications are for channel 1 only, after 2-hour warm-up, resolution at 7.5 digits (100 NPLC) with filters off, for 4-wire Ω or 2-wire Ω using Null.

<sup>4</sup> For 25 Ω SPRT with triple-point of water check within last 4 hours. With no triple-point of water check, add 0.013°C for 24-hour, 0.035°C for 90-day, and 0.055°C for 1-year specifications.

<sup>5</sup> For fixed reference junction. Add 0.3°C for external reference junction, add 2.0°C for internal reference junction.

# Frequency Counters

Selection Guide	Model	Frequency range (optional range)	Frequency resolution	Best Sensitivity	Time Interval resolution (single-shot LSD)	Additional features
Two channel frequency counters w/time interval <sup>1</sup>	53131A	225 MHz (3, 5, 12.4 GHz)	10 digits/s	20 mVrms	500 ps	PIB standard, full math, statistics, limit testing, auto pulse characterization
	53132A	225 MHz (3, 5, 12.4 GHz)	12 digits/s	20 mVrms	150 ps	PIB standard, full math, statistics, limit testing, auto pulse characterization
Single channel frequency counter	53181A	225 MHz (1.5, 3, 5, 12.4 GHz)	10 digits/s	20 mVrms		PIB standard, full math, statistics, limit testing
CW Microwave counters	53150A	20 GHz	1 Hz	-30 dBm		PIB standard, battery optional, Simultaneous power measurement
	53151A	26.5 GHz	1 Hz	-30 dBm		PIB standard, battery optional, Simultaneous power measurement
	53152A	46 GHz	1 Hz	-30 dBm		PIB standard, battery optional, Simultaneous power measurement
CW Microwave counters/ power meter/DVMs	53147A	20 GHz	1 Hz	-30 dBm		PIB and DVM standard, battery optional, -70 dBm to +20 dBm true power meter
	53148A	26.5 GHz	1 Hz	-30 dBm		PIB standard, battery optional, -70 dBm to +20 dBm true power meter
	53149A	46 GHz	1 Hz	-30 dBm		PIB standard, battery optional, -70 dBm to +20 dBm true power meter

<sup>1</sup> Channel 2 can be used to make frequency, period, ratio, and voltage measurements - measurements on channel 1 and channel 2 are made sequentially.

## Additional frequency counters

Agilent also offers frequency counters for VXI and the popular 34980A and 34970A data acquisition mainframes. More information is available for these counters on the Agilent website.

## Connectivity

Agilent provides IntuiLink a free software application for your PC. IntuiLink allows you to easily transfer measurement data and images into familiar PC applications like Microsoft Office Excel and Word. IntuiLink can be downloaded free of charge at [www.agilent.com/find/intuilink](http://www.agilent.com/find/intuilink). IntuiLink supports the 53131A, 53132A and the 53181A. Agilent offers the 82357A USB to GPIB converter making it easy to connect your counter to a PC using USB.

More detailed specifications at [www.agilent.com/find/power](http://www.agilent.com/find/power)



# Frequency Counters

## 53131A, 53132A, and 53181A

225 MHz bandwidth (optional 1.5, 3, 5, or 12.4 GHz)

10- or 12-digit/s resolution

GPIO interface and IntuiLink connectivity software standard

Data transfer rate of up to 200 fully formatted measurements / second

### Abbreviated technical specifications

#### A family of frequency counters to meet your needs

Agilent Technologies 53131A, 53132A and 53181A frequency counters give you fast, precise frequency measurements at an affordable price. These counters feature an intuitive user interface and one-button access to frequently used functions so you can make accurate measurements quickly and easily. Real-time digital signal processing technology is used to analyze data while simultaneously taking new readings, speeding measurement throughput.

This series of counters offers built-in statistics and math functions so you can scale measurements and simultaneously measure and track average, min/max and standard deviation. Automated limit testing lets you set upper and lower limits for any measurement. The analog display mode lets you see at a glance whether a measurement is within pass/fail limits. The counters flag out-of-limit conditions and can generate an output signal to trigger external devices when a limit is exceeded. For quick access to frequently used tests, a single keystroke recalls up to 20 different stored front-panel set-ups.

	53131A	53132A	53181A
<b>Type</b>	Two channel, universal <sup>1</sup>	Two channel, universal <sup>1</sup>	One channel RF
<b>Measurements</b>	Frequency, frequency ratio, time interval, period, rise/fall time, positive/negative pulse width, duty cycle, phase, totalize, peak voltage, time interval average, time interval delay		Frequency, frequency ratio (with optional second channel 2), period, peak voltage
<b>Analysis</b>	Automatic limit testing, math (scale and offset), statistics (minimum, maximum, mean, standard deviation)		
<b>Frequency range</b> (optional channel)	DC to 225 MHz (3, 5 or 12.4 GHz)	DC to 225 MHz (3, 5 or 12.4 GHz)	DC to 225 MHz (1.5, 3, 5 or 12.4 GHz)
<b>Resolution</b> (frequency, time interval)	10 digits/s, 500 ps	12 digits/s, 150 ps	10 digits/s, N/A
<b>Measurement speed</b>	Up to 200 meas/s over GPIO	Up to 200 meas/s over GPIO	Up to 200 meas/s over GPIO
<b>Voltage range &amp; sensitivity (Sinusoid)</b>			
DC to 100 MHz	20 mVrms to $\pm 5$ Vac +DC	20 mVrms to $\pm 5$ Vac +DC	20 mVrms to $\pm 5$ Vac +DC
100 to 200 MHz	30 mVrms to $\pm 5$ Vac +DC	30 mVrms to $\pm 5$ Vac +DC	30 mVrms to $\pm 5$ Vac +DC
200 to 225 MHz	40 mVrms to $\pm 5$ Vac +DC	40 mVrms to $\pm 5$ Vac +DC	40 mVrms to $\pm 5$ Vac +DC
With Optional Channel	75 mVrms to $\pm 5$ Vac +DC	75 mVrms to $\pm 5$ Vac +DC	75 mVrms to $\pm 5$ Vac +DC
<b>Input Conditioning</b>	(Independently selectable on CH 1 & 2)	(Independently selectable on CH 1 & 2)	(Independently selectable on CH 1)
<b>Impedance coupling</b>	1 M $\Omega$ or 50 $\Omega$ , AC or DC	1 M $\Omega$ or 50 $\Omega$ , AC or DC	1 M $\Omega$ or 50 $\Omega$ , AC or DC
<b>Low pass filter</b>	100 kHz or none	100 kHz or none	100 kHz or none
<b>Attenuation</b>	x1 or x10	x1 or x10	x1 or x10
<b>External timebase reference Input</b>	1, 5, 10 MHz	10 MHz	1, 5, 10 MHz
<b>Trigger</b>	CH 1 & CH 2	CH 1 & CH 2	CH 1
	Trigger on rising/falling edge; set level as a percent of signal level or voltage; Sensitivity can be set as LOW, MED, HIGH		
<b>Gating and arming</b>	Auto, manual (set gate time or number of digits of resolution); external, delay (expanded on 53132A)		
<b>Interfaces</b>	GPIO (IEEE 488.1 and 488.2) with SCPI-compatible language; talk only RS-232		
<b>Power</b>	AC line selection is automatic 100 to 120 VAC $\pm 10\%$ at 50, 60, or 400 Hz $\pm 10\%$ 220 to 240 VAC $\pm 10\%$ at 50, 60 Hz $\pm 10\%$		
<b>Net weight/size</b>	3 kg (6.5 lbs.) 88.5mm H x 212.6mm W x 348.3mm D (3.54 in x 8.50 in x 13.932 in)		

<sup>1</sup> Channel 2 can only be used to make frequency, period, ratio, and voltage measurements - measurements on channel 1 and channel 2 are made sequentially.

## Frequency Counters 53131A, 53132A, and 53181A (Continued)

### Standard and optional high stability timebases

#### Agilent 53131A Universal Counter

The two-channel 53131A counter offers a bandwidth of 225 MHz with a resolution of 10 digits per second when measuring frequency or period. Time interval measurements may also be made with a resolution of 500 ps. An optional third channel can be added to any counter to provide frequency measurements up to 3 GHz, 5 GHz, or 12.4 GHz.

#### Agilent 53132A Universal Counter

For applications requiring higher resolution, the 53132A offers the same features and functions as the 53131A, with up to 12 digits per second frequency resolution and 150 ps time interval resolution. If more accuracy is required, a choice of optional timebases may be added to any of the counters. In addition, the 53132A offers advanced arming modes for time interval measurements.

#### Agilent 53181A RF Counter

Optimized for RF applications, the single-channel 10 digits per second. 53181A measures frequency, period and peak voltage. A digit-blanking function easily eliminates unnecessary digits when you want to read measurements quickly. For higher frequency measurements, choose an optional second channel. A self-guided menu makes this counter exceptionally easy to use.

#### Connectivity

For computer-controlled systems applications, each counter includes a standard GPIB interface with full SCPI-compatible programmability and a data transfer rate of up to 200 fully formatted measurements

	Standard (0° to 50°C)	Medium Oven Option 001	High Oven Option 010	Ultra High Oven Option 012
<b>Temperature stability</b> (referenced to 25° C)	$< 5 \times 10^{-6}$	$< 2 \times 10^{-7}$	$< 2.5 \times 10^{-9}$	$< 2.5 \times 10^{-9}$
<b>Aging Rate</b> (after 30 days) Per Day: Per Month: Per Year:	$< 3 \times 10^{-7}$	$< 4 \times 10^{-8}$ $< 2 \times 10^{-7}$	$< 5 \times 10^{-10}$ $< 1.5 \times 10^{-8}$	$< 1 \times 10^{-10}$ $< 3 \times 10^{-9}$ $< 2 \times 10^{-8}$
<b>Turn-on stability vs. time (30 minutes)</b>		$< 2 \times 10^{-7}$ (Referenced to 2 hours)	$< 5 \times 10^{-9}$ (Referenced to 24 hours)	$< 5 \times 10^{-9}$ (Referenced to 24 hours)
<b>Calibration</b>	Manual Adjust	Electronic	Electronic	Electronic

**Note:** that power to the time base is maintained when the counter is placed in standby via the front panel switch. The internal fan will continue to operate when in standby to maintain long-term measurement reliability.

Optional High Frequency Channels	Frequency range	Connector	Coupling	Power range and sensitivity	Damage level
<b>Option 015<sup>1</sup></b> 1.5 GHz Channel	100 MHz to 1.5 GHz	BNC	AC	-27 dBm to +19 dBm	5 Vrms
<b>Option 030</b> 3.0 GHz Channel	100 MHz to 3.0 GHz	BNC	AC	-27 dBm to +19 dBm (100 MHz to 2.7 GHz) -21 dBm to +13 dBm (2.7 GHz to 3 GHz)	5 Vrms
<b>Option 050</b> 5.0 GHz Channel	200 MHz to 5.0 GHz	Type-N	AC	-23 dBm to +13 dBm	25 dBm
<b>Option 124</b> 12.4 GHz Channel	200 MHz to 12.4 GHz	Type-N	AC	-23 dBm to +13 dBm	25 dBm

<sup>1</sup> Option 015 is available only for the 53181A

per second. Measurements can be transferred via USB with an optional 82357A GPIB to USB converter. The standard RS-232 talk-only interface provides printer support or data transfer to a computer through a terminal-emulation program.

IntuiLink, free PC connectivity software allows you to easily transfer measurement data and images into familiar PC applications like Microsoft Office Excel and Word, with little or no programming. Use the following link for additional and downloading instructions.  
[www.agilent.com/find/intuilink](http://www.agilent.com/find/intuilink)

## Frequency Counters 53131A, 53132A, and 53181A (Continued)

### Drivers

#### 53131A/53132A/53181A:

IntuiLink Connectivity Software

### Application Notes:

#### 8 Hints for Making Better RF Counter Measurements

This brochure focuses on making better RF counter measurements by understanding the effects of counter architecture; recognizing the difference between resolution and accuracy, and scheduling calibration to match performance needs.

5967-6038E

Find a video demo, specifications calculator and more at

[www.agilent.com/find/frequencycounters](http://www.agilent.com/find/frequencycounters)

#### Configure a counter that is right for your application

Start by selecting a counter, either the 53131A, 53132A, or 53181A.

Don't know which one to choose?

Check out our most popular 53131A. Then choose the timebase that is the best fit for your application. Optional timebases improve stability due to changes in temperature or time and provide the convenience of electronic calibration. Finally, an optional RF channel can be added to measure signals up to 12.4 GHz – opt 030, a 3 GHz RF channel is a common choice.

### Ordering Information

#### Agilent 53131A

Universal Counter, 10 digit/s

#### Agilent 53132A

Universal Counter, 12 digit/s

#### Agilent 53181A

RF Counter, 10 digit/s

**Option 001** Medium stability timebase

**Option 010** High stability timebase

**Option 012** Ultra stability timebase

**Option 015** 1.5 GHz Ch. w/BNC connector

**Option 030** 3.0 GHz Ch. w/BNC connector

**Option 050** 5.0 GHz Ch. w/Type-N connector

**Option 124** 12.4 GHz Ch. w/Type-N connector

<sup>1</sup>Option 015 is available only for the 53131A

**Option 060** Adds parallel 225 MHz channel(s) to rear panel

**Option 061** Adds parallel 225 MHz channel(s) to rear panel and moves option 030 to rear panel.

**Option 062** Adds parallel 225 MHz channel(s) to rear panel, opt 050 or opt 124 remain on front panel.

**Option 1CM** Rack mount kit

**82357A** Optional USB Interface



53147A - 53149A

## Microwave Frequency Counter w/power meter, 53140 Series

A choice of frequency counter ranges up to 46 GHz

A true power meter to meet your “laboratory-accuracy” requirements

A DC DVM to assist with antenna alignment and telecom power supply measurements

GPIO and RS232 standard

### Abbreviated technical data

#### Simplify design and verification of point-to-point microwave links

Whether you are designing or verifying cell-site to base-station links, business-to-business communication links, digital radio links (along railroads, pipelines or power lines) or even satellite ground stations, designing and verifying microwave links typically requires three pieces of equipment. These are a CW microwave counter, a true power meter and a DC DVM.

#### Save ATE rack space and budget dollars by combining three instruments into one

For measurements used in microwave component and assembly testing, the compact, three-in-one 53140 series reduces the need for expensive ATE rack space. The 53140 series comes ATE-ready with both GPIO and RS-232 SCPI programmable interfaces. A rack mount kit is optional.

#### CW microwave counter up to 46 GHz

Choose the frequency range you need. The 53140 series has three ranges; 20 GHz, 26.5 GHz and 46 GHz. The ultra-wideband microwave input covers from 50 MHz up to the maximum frequency. This reduces the need for channel

Input characteristics		Agilent 53147A	Agilent 53148A	Agilent 53149A
Frequency range	Channel 1 Normal mode Low pass filter enabled	10 Hz - 125 MHz 10 Hz - 50 kHz	10 Hz - 125 MHz 10 Hz - 50 kHz	10 Hz - 125 MHz 10 Hz - 50 kHz
	Channel 2	50 MHz - 20 GHz	50 MHz - 26.5 GHz	50 MHz - 46.0 GHz
Sensitivity	Channel 1 10-30 Hz 30 Hz-125 MHz	40 mV 25 mV	40 mV 25 mV	40 mV 25 mV
	Channel 2 50-250 MHz 0.25-12.4 GHz 12.4-18 GHz 18-20 GHz 20-26.5 GHz 26.5-40 GHz 40-46 GHz	-20 dBm -33 dBm -33 dBm -29 dBm N/A N/A N/A	-20 dBm -33 dBm -33 dBm -29 dBm -25 dBm N/A N/A	-20 dBm -33 dBm -30 dBm -27 dBm -27 dBm -23 dBm -17 dBm
	Maximum input	2 Vrms	2 Vrms	2 Vrms
	Channel 2 50 MHz - 2 GHz 2-46 GHz	+5 dBm +13 dBm	+5 dBm +13 dBm	+5 dBm +13 dBm
	Damage level	120 V <sub>pk</sub> (DC + AC) linearly derated to 5 Vrms at 125 MHz	120 V <sub>pk</sub> (DC + AC) linearly derated to 5 Vrms at 125 MHz	120 V <sub>pk</sub> (DC + AC) linearly derated to 5 Vrms at 125 MHz
	Channel 2	+27 dBm	+27 dBm	+27 dBm
	Impedance (Nominal)	1 MΩ / 60 pF	1 MΩ / 60 pF	1 MΩ / 60 pF
Connector	Channel 1	BNC female	BNC female	BNC female
	Channel 2	SMA/APC-3.5 compatible female	SMA/APC-3.5 compatible female	2.92 mm removable, SMA/APC-3.5 compatible female
SWR (typical)	Channel 2 50-250 MHz	1.5:1	1.5:1	1.5:1
	0.25-10 GHz	2.0:1	2.0:1	2.0:1
	10-20 GHz	3.0:1	3.0:1	3.0:1
	20-26.5 GHz	N/A	3.0:1	2.5:1
	26.5-46 GHz	N/A	N/A	2.5:1

More detailed specifications at [www.agilent.com/find/microwavecounters](http://www.agilent.com/find/microwavecounters)

## Microwave Frequency Counter w/power meter, 53140 Series (Continued)

### Abbreviated technical data

switching. You don't have to wait for resolution that is not needed, as the resolution is selectable from 1 Hz to 1 MHz. For better measurement accuracy over time and temperature, an optional oven timebase is available.

#### True power meter with a wide selection of sensors

The 53140 series true power meter provides laboratory instrument. Obtain 0.01 dB resolution and 0.02 dB basic instrument accuracy.

#### DC DVM for AGC and power supply measurements

A  $\pm 50$  Vdc DVM monitors the microwave receiver's AGC circuitry for assistance during antenna alignment. The DVM can also check the -48 Vdc power supplies typically found at telecom sites.

#### Advanced instrument features that help make the job easier

The Agilent 53140 series has the features you expect in a precision laboratory instrument. Relative readings for both frequency and power measurements show deviations from nominal values. Offset reading allows indirect measurement of either final frequency or power values or both. Averaging smoothes out rapidly changing measurement displays for ease of viewing.

Input characteristics		Agilent 53147A	Agilent 53148A	Agilent 53149A
Coupling	Channel 1	AC	AC	AC
	Channel 2	AC	AC	AC
Acquisition time (1 MHz FM rate)	Channel 1	N/A	N/A	N/A
	Channel 2 (FM Auto/FM Off)	150 ms/125 ms	150 ms/125 ms	165 ms/140 ms
Resolution	Channel 1/ Channel 2	1 Hz to 1 MHz	1 Hz to 1 MHz	1 Hz to 1 MHz
Emissions ("kickback noise")	Channel 1	N/A	N/A	N/A
	Channel 2 (measuring/no input)	-40 dBm / <-70 dBm	-40 dBm / <-70 dBm	-40 dBm / <-70 dBm
Residual stability*	Channel 1	N/A	N/A	N/A
	Channel 2	0.6 LSD rms	0.8 LSD rms	1.25 LSD rms
*Counter and source tied to same timebase				
Accuracy	Channel 1/ Channel 2	$\pm 1$ LSD $\pm$ residual stability $\pm$ timebase error x frequency	$\pm 1$ LSD $\pm$ residual stability $\pm$ timebase error x frequency	$\pm 1$ LSD $\pm$ residual stability $\pm$ timebase error x frequency
Measurement time	Channel 1	1/Resolution + 30 ms	1/Resolution + 30 ms	1/Resolution + 30 ms
	Channel 2	1/Resolution + acquisition time + 30 ms	1/Resolution + acquisition time + 30 ms	1/Resolution + acquisition time + 30 ms
FM tolerance	Channel 1	N/A	N/A	N/A
	Channel 2 (FM Auto)	20 MHz p-p max @ 10 MHz rate	20 MHz p-p max @ 10 MHz rate	20 MHz p-p max to 26.5 GHz, 12 MHz p-p max above 26.5 GHz @ 10 MHz rate
	(FM Off)	1 MHz p-p @ 10 MHz rate	1 MHz p-p @ 10 MHz rate	1 MHz p-p @ 10 MHz rate
Power Meter Specifications	Frequency range	100 kHz to 50 GHz, sensor dependent.		
	Power range	-70 to +44 dBm, sensor dependent.		
	Power sensors supported	8480 series		
	Resolution	0.01 dB in log mode, 0.1% of full scale in linear mode.		
	Display units	Absolute dBm or Watts, Relative dB or %		
	Accuracy	Instrumentation $\pm 0.02$ dB or $\pm 0.5\%$ . Add power sensor linearity specification for overall system accuracy.		
		Zero set (digital setting capability of zero) Sensor dependent		
	Power reference	Power output 1.00 mW. Factory set to $\pm 0.7\%$ , traceable to NIST.		
		Accuracy $\pm 1.2\%$ worst case ( $\pm 0.9$ RSS) for one year.		
		Frequency 50 MHz (nominal)		
DVM Specifications	Function	DC Volts		
	Range	$\pm 50$ Vdc		
	Resolution	2 mV		
	Accuracy	$\pm 0.25\%$ of reading $\pm 10$ mV		
	Display	Replaces frequency display when DVM is activated		

More detailed specifications at [www.agilent.com/find/microwavecounters](http://www.agilent.com/find/microwavecounters)

## Microwave Frequency Counter w/power meter, 53140 Series (Continued)

### General information

**Save and recall:** Up to 9 complete instrument setups may be saved and later recalled. These setups are retained when power is removed.

**Sample rate:** User-selectable  
Fast (nominally 20 ms between readings), Medium (nominally 250 ms between readings), Slow (nominally 1 s between readings) and Hold.

**Size:** 330mm W x 156 mm H x 376 mm

**Operating temperature:** 0-55°C  
With battery option: 0-40°C

**Weight:** 4.5 kg without battery option, 6.6 kg with battery option

**Warranty:** 1 year

### Ordering Information

**Agilent 53147A**  
20 GHz Counter/Power Meter/DVM

**Agilent 53148A**  
26.5 GHz Counter/Power Meter/

**Agilent 53149A**  
46 GHz Counter/Power Meter/DVM

**Option 001** Oven timebase

**Option 002** Battery and DC input

**Option 007** Soft carrying case

**Option 1CM** Rack mounting kit

Internal timebase stability		TCXO Standard	Oven Option 001
Frequency		10 MHz	10 MHz
External Input		1, 2, 5, 10 MHz	1, 2, 5, 10 MHz
Aging rate	Per Day	—	$< 5 \times 10^{-10}$
	Per Month	$< 1 \times 10^{-7}$	$< 1.5 \times 10^{-8}$
Short term	(1 sec. avg. time)	$< 1 \times 10^{-9}$	$< 2 \times 10^{-10}$
Line variation	( $\pm 10\%$ )	$< 1 \times 10^{-7}$	$< 1 \times 10^{-10}$
Warm-up		—	$< 1 \times 10^{-8}$ within 5 min. after turn-on at 25°C
Temperature stability	(0-55°C)	$< 1 \times 10^{-6}$	$< 3 \times 10^{-9}$

### Power Sensors

**8481B** 25 W Power Sensor, 18 GHz

**8482B** 25 W Power Sensor, 4.2 GHz

**8481H** 3 W Power Sensor, 18 GHz

**8482H** 3 W Power Sensor, 4.2 GHz

**8485D** 100 mW Power Sensor, 26.5 GHz

**8485D-033** 100 mW Power Sensor, 33 GHz

**8481A** 100 mW Power Sensor, 18 GHz

**8482A** 100 mW Power Sensor, 4.2 GHz

**8487A** 100 mW Power Sensor, 50 GHz

### Application Information

#### 4 Hints for Making Better

#### Microwave Counter Measurements

This Product Note provides four pertinent hints for making better microwave counter measurements, describes the advantages of using a microwave counter, and deals with the unique measurement problems created by the advancement in counter technology.  
5967-6195E



# Microwave CW Frequency Counters

## 53150 Series



53150A - 53152A

Ultrawide range, single input (from 50 MHz up to 46 GHz)  
 Simultaneous power and measurement with analog indicator  
 GPIB and RS-232 standard  
 Lightweight and rugged  
 Optional battery

### Abbreviated technical data

#### Convenience, portability and outstanding performance

The innovative designs of the Agilent 53150 Series microwave counters offer an uncluttered, feature laden front panel. These designs present no-compromise performance and quality in a surprisingly small, light, battery operated product.

#### The convenience of a single microwave input

The Agilent 53150 Series has an advanced sampler that integrates a separate zero bias Schottky diode for the accurate measurement of input power. This allows measurement of both frequency and power with a single connection. No compromise in frequency coverage is required for this capability. The ultrawideband microwave input covers the entire RF and microwave spectrum, from intermediate frequencies (IFs) of 50 MHz to millimeter waves.

The power measurement accuracy and repeatability of these counters rivals power meters with diode sensors.

Input characteristics		Agilent 53150A	Agilent 53151A	Agilent 53152A
Frequency range	Channel 1 Normal mode Low pass filter enabled	10 Hz - 125 MHz 10 Hz - 50 kHz	10 Hz - 125 MHz 10 Hz - 50 kHz	10 Hz - 125 MHz 10 Hz - 50 kHz
	Channel 2	50 MHz - 20 GHz	50 MHz - 26.5 GHz	50 MHz - 46.0 GHz
Sensitivity	Channel 1 10-30 Hz 30 Hz-125 MHz	40 mV 25 mV	40 mV 25 mV	40 mV 25 mV
	Channel 2 50-250 MHz 0.25-12.4 GHz 12.4-18 GHz 18-20 GHz 20-26.5 GHz 26.5-40 GHz 40-46 GHz	-20 dBm -33 dBm -33 dBm -29 dBm N/A N/A N/A	-20 dBm -33 dBm -33 dBm -29 dBm -25 dBm N/A N/A	-20 dBm -33 dBm -30 dBm -27 dBm -27 dBm -23 dBm -17 dBm
	Maximum input	2 Vrms	2 Vrms	2 Vrms
	Channel 2 50 MHz - 2 GHz 2-46 GHz	+5 dBm +13 dBm	+5 dBm +13 dBm	+5 dBm +13 dBm
	Damage level	120 V (DC + AC pk) linearly derated to 5 Vrms at 125 MHz +27 dBm	120 V (DC + AC pk) linearly derated to 5 Vrms at 125 MHz +27 dBm	120 V (DC + AC pk) linearly derated to 5 Vrms at 125 MHz +27 dBm
	Impedance (Nominal)	1 MΩ / 60 pF	1 MΩ / 60 pF	1 MΩ / 60 pF
	Channel 2	50 Ω	50 Ω	50 Ω
Connector	Channel 1	BNC female	BNC female	BNC female
	Channel 2	SMA or APC-3.5 compatible female	SMA or APC-3.5 compatible female	2.92 mm removable, SMA or APC-3.5 compatible female
SWR	Channel 2			
	50-250 MHz	1.5:1 typical	1.5:1 typical	1.5:1 typical
	0.25-10 GHz	2.0:1 typical	2.0:1 typical	2.0:1 typical
	10-20 GHz	3.0:1 typical	3.0:1 typical	3.0:1 typical
	20-26.5 GHz	N/A	3.0:1 typical	2.5:1 typical
	26.5-46 GHz	N/A	N/A	2.5:1 typical

## Microwave CW Frequency Counters

### 53150 Series (Continued)

#### Abbreviated technical data

#### Field tough but ready for bench-top or ATE applications

The Agilent 53150 Series is as comfortable in the field as in the laboratory. The rugged case with an integrated tilting handle can tolerate the vibration and shock expected in field use. The backlit LCD display ensures visibility in all environments, from dark to full sunlight, at distances exceeding 15 feet.

If AC power is unavailable, the internal, replaceable camcorder batteries provide at least 2.5 hours of continuous operation. The unit can also be powered from an external 11-18 Vdc source.

For benchtop and ATE applications, the Agilent 53150 Series delivers full functionality and high measurement speed. The fully programmable RS-232 interface and high speed GPIB interface are standard features.

#### General information

**Save and recall:** Up to 9 complete instrument setups may be saved and later recalled. These setups are retained when power is removed.

**Sample rate:** User-selectable  
Fast (nominally 20 ms between readings),  
Medium (nominally 250 ms between readings),  
Slow (nominally 1 s between readings) and Hold.

**Size:** 213 mm W x 88.5 mm H x 300 mm

**Operating temperature:** 0-55°C  
With battery option: 0-40°C

**Weight:** 4 kg without battery option,  
6.4 kg with battery option

**Warranty:** 1 year

**Programming:** GPIB (IEEE-488.1-1987,  
IEEE 488.2-1987) or RS-232C

**Language:** SCPI-1992.0 (Standard  
Commands for Programmable Instruments)

**RS-232C rates:** User-selectable 2400  
19200 baud

Input characteristics		Agilent 53150A	Agilent 53151A	Agilent 53152A
Coupling	Channel 1	AC	AC	AC
	Channel 2	AC	AC	AC
Acquisition time (1 MHz FM rate)	Channel 1	N/A	N/A	N/A
	Channel 2 (FM Auto/FM Off)	125 ms/100 ms	125 ms/100 ms	140 ms/115 ms
Resolution	Channel 1/ Channel 2	1 Hz to 1 MHz	1 Hz to 1 MHz	1 Hz to 1 MHz
Emissions ("kickback noise")	Channel 1	N/A	N/A	N/A
	Channel 2 (measuring/ no input)	-40 dBm / <-70 dBm	-40 dBm / <-70 dBm	-40 dBm / <-70 dBm
Residual stability*	Channel 1	N/A	N/A	N/A
	Channel 2 *Counter and source tied to same timebase	0.6 LSD rms	0.8 LSD rms	1.25 LSD rms
Accuracy	Channel 1/ Channel 2	±1 LSD ± timebase error x frequency	±1 LSD ± timebase error x frequency	±1 LSD ± timebase error x frequency
Measurement time	Channel 1	1/Resolution + 20 ms	1/Resolution + 20 ms	1/Resolution + 20 ms
	Channel 2	1/Resolution + acquisition time + 20 ms	1/Resolution + acquisition time + 20 ms	1/Resolution + acquisition time + 20 ms
FM tolerance	Channel 1	N/A	N/A	N/A
	Channel 2 (FM Auto) (FM Off)	20 MHz p-p max @ 10 MHz rate  1 MHz p-p @ 10 MHz rate	20 MHz p-p max @ 10 MHz rate  1 MHz p-p @ 10 MHz rate	20 MHz p-p max to 26.5 GHz, 12 MHz p-p max above 26.5 GHz @ 10 MHz rate 1 MHz p-p @ 10 MHz rate
Power measurement	Channel 1	N/A	N/A	N/A
	Channel 2	N/A	N/A	N/A
	Range	Counter sensitivity to +7 dBm	Counter sensitivity to +7 dBm	Counter sensitivity to +7 dBm
	Accuracy at input connector** (0 dBm to -20 dBm)	±1.5 dB 0.05-12.4 GHz 12.4-20 GHz 26.5-46 GHz	±1.5 dB ±1.5 dB ±2.0 dB N/A	±1.0 dB ±1.5 dB ±1.5 dB ±2.0 dB
	Resolution	0.01 dB	0.01 dB	0.01 dB
Display		dBm or milliwatts/ microwatts	dBm or milliwatts/ microwatts	dBm or milliwatts/ microwatts

More detailed specifications at [www.agilent.com/find/microwavecounters](http://www.agilent.com/find/microwavecounters)

## Microwave CW Frequency Counters

### 53150 Series (Continued)

**Power supply:**

**AC:** 90-132 Vac; 47.5-66 Hz or 360-440  
216-264 Vac; 47.5-66 Hz line selection:  
automatic power requirements:  
75 VA max. (25 W typ.)

**DC (Option 002 only):** 11-18 Vdc; 2A

**Battery (Option 002):**

**Type:** VHS camcorder, lead acid (2

**Charge Time:** 8 hours in unit

**Capacity:** 2.5 hours min. at 25°C

**Ordering Information****Agilent 53150A**

Microwave frequency counter, 20 GHz

**Agilent 53151A**

Microwave frequency counter, 26.5 GHz

**Agilent 53152A**

Microwave frequency counter, 46 GHz

**Options**

**Opt 001** Oven Timebase

**Opt 002** Battery and DC input

**Accessories**

Battery charger 53150-60217

Spare battery 53150-80010

DC Power input cable 53150-60214

Internal timebase stability	TCXO Standard	Oven Option 001
<b>Frequency</b>	10 MHz	10 MHz
<b>External Input</b>	1, 2, 5, 10 MHz	1, 2, 5, 10 MHz
<b>Aging rate</b> Per Day Per Month	— < 1 x 10 <sup>-7</sup>	< 5 x 10 <sup>-10</sup> < 1.5 x 10 <sup>-8</sup>
<b>Short term</b> (1 sec. avg. time)	< 1 x 10 <sup>-9</sup>	< 2 x 10 <sup>-10</sup>
<b>Line variation</b> (±10%)	< 1 x 10 <sup>-7</sup>	< 1 x 10 <sup>-10</sup>
<b>Warm-up</b>	—	< 1 x 10 <sup>-8</sup> within 5 min. after turn-on at 25°C
<b>Temperature stability</b> (0-55°C)	< 1 x 10 <sup>-8</sup>	< 3 x 10 <sup>-9</sup>

**Application Information****4 Hints for Making Better Microwave Counter Measurements**

This Product Note provides four pertinent hints for making better microwave counter measurements, describes the advantages of using a microwave counter, and deals with the unique measurement problems created by the advancement in counter technology.  
5967-6195E

**Drivers**

None

# Function/Arbitrary Waveform Generators

Selection Guide		33220A Function/Arbitrary Waveform Generator, 20 MHz	33250A Function/Arbitrary Waveform Generator, 80 MHz
Frequency range (sine, square)		1 $\mu$ Hz to 20 MHz	1 $\mu$ Hz to 80 MHz
Standard waveforms		Sine, square, pulse, triangle, ramp, noise, sin(x)/x, exponential rise and fall, cardiac, DC volts	Sine, square, pulse, triangle, ramp, noise, sin(x)/x, exponential rise and fall, cardiac, DC volts
Arbitrary waveforms		2 to 64 K-points	1 to 64 K-points
Sample rate		50 MSa/s	200 MSa/s
Modulation		AM, FM, PM, FSK, PWM, sweep and burst (all internal/external)	AM, FM, FSK, burst (all internal/external)
Sweep		Linear or logarithmic; up or down	Linear or logarithmic; up or down
External clock reference		Optional External lock range: 10 MHz $\pm$ 500 Hz Internal frequency: 10 MHz	Standard External lock range: 10 MHz $\pm$ 35 kHz Internal frequency: 10 MHz
Connectivity (Intuilink Software included)		GPIO, USB, LAN	GPIO, RS-232, Optional USB w/82357A

More detailed specifications at [www.agilent.com/find/power](http://www.agilent.com/find/power)



33220A

## Function/Arbitrary Waveform Generator 33220A 20 MHz

20 MHz Sine and Square waveforms  
 Ramp, Triangle, Noise, and DC waveforms  
 5 MHz pulse with variable edge-time  
 14-bit, 50 MSa/s, 64 K-point Arbitrary waveforms  
 AM, FM, PM, FSK, and PWM modulation types  
 Linear & logarithmic sweeps and burst operation

Agilent  
Open

### Specifications

(at 0° to 55°C unless  
otherwise specified)

#### Uncompromising performance for functions and waveforms

The Agilent Technologies 33220A Function/Arbitrary Waveform Generator uses direct digital synthesis (DDS) techniques to create a stable, accurate output signal for clean, low distortion sine waves. It also gives you square waves with fast rise and fall times up to 20 MHz and linear ramp waves up to 200 kHz.

#### Pulse generation

The 33220A can generate variable-edge-time pulses up to 5 MHz. With variable period, pulse width, and amplitude the 33220A is ideally suited to a wide variety of applications requiring a flexible pulse signal.

#### Custom waveform generation

Use the 33220A to generate complex custom waveforms. With 14-bit resolution, and a sampling rate of 50 MSa/s, the 33220A gives you the flexibility to create the waveforms you need. It also lets you store up to four waveforms in nonvolatile memory.

#### Waveforms

**Standard** Sine, Square, Ramp, Triangle, Pulse, Noise, DC

**Built-in arbitrary** Exponential rise, Exponential fall, Negative ramp, Sin(x)/x, Cardiac

#### Waveform Characteristics

<b>Sine</b>	<b>Frequency Range</b>	1 $\mu$ Hz to 20 MHz	
	<b>Amplitude Flatness</b> <sup>1,2</sup>	(relative to 1 kHz) < 100 kHz 100 kHz to 5 MHz 5 MHz to 20 MHz	0.1 dB 0.15 dB 0.3 dB
	<b>Harmonic distortion</b> <sup>2,3</sup>	< 1 V <sub>pp</sub> DC to 20 kHz 20 kHz to 100 kHz 100 kHz to 1 MHz 1 MHz to 20 MHz	$\geq$ 1 V <sub>pp</sub> -70 dBc -60 dBc -45 dBc -35 dBc
	<b>Spurious (non-harmonic)</b> <sup>2,4</sup>	DC to 1 MHz 1 MHz to 20 MHz	-70 dBc -70 dBc + 6 dB/octave
<b>Square</b>	<b>Frequency range</b>	1 $\mu$ Hz to 20 MHz	
	<b>Rise/Fall time</b>	< 13 ns	
	<b>Overshoot</b>	< 2%	
	<b>Variable duty cycle</b>	20% to 80% (to 10 MHz) 40% to 60% (to 20 MHz)	
<b>Ramp, Triangle</b>	<b>Frequency range</b>	1 $\mu$ Hz to 200 kHz	
	<b>Linearity</b>	< 0.1% of peak output	
	<b>Variable Symmetry</b>	0.0% to 100.0%	
<b>Pulse</b>	<b>Frequency range</b>	500 $\mu$ Hz to 5 MHz	
	<b>Pulse width (period <math>\leq</math> 10s)</b>	20 ns minimum, 10 ns resolution	
	<b>Variable edge time</b>	< 13 ns to 100 ns	
<b>Noise</b>	<b>Bandwidth</b>	10 MHz typical	
<b>Arbitrary</b>	<b>Frequency range</b>	1 $\mu$ Hz to 6 MHz	
	<b>Waveform length</b>	2 to 64 K points	
	<b>Amplitude resolution</b>	14 bits (including sign)	
	<b>Sample rate</b>	50 MSa/s	
	<b>Non-volatile memory</b>	four waveforms	

More detailed specifications at [www.agilent.com/find/33220A](http://www.agilent.com/find/33220A)

## Function/Arbitrary Waveform Generator

### 33220A 20 MHz (Continued)

#### Specifications

(at 0° to 55° C unless otherwise specified)

#### Easy-to-use functionality

Front-panel operation of the 33220A is straight-forward and user friendly. You can access all major functions with a single key or two. The knob or numeric keypad can be used to adjust frequency, amplitude, offset, and other parameters. You can even enter voltage values directly in  $V_{pp}$ ,  $V_{rms}$ , dBm, or as high and low levels. Timing parameters can be entered in Hertz (Hz) or seconds.

Internal AM, FM, PM, FSK, and PWM modulation make it easy to modulate waveforms without the need for a separate modulation source. Linear and logarithmic sweeps are also built in, with sweep rates selectable from 1 ms to 500 s. Burst mode operation allows for a user-selected number of cycles per period of time. GPIB, LAN, and USB interfaces are all standard, plus you get full programmability using SCPI commands.

#### External frequency reference (Option 001)

The 33220A external frequency reference lets you synchronize to an external 10 MHz clock, to another 33220A, or to an Agilent 33250A. Phase adjustments can be made from the front panel or via a computer interface, allowing precise phase calibration and adjustment.

#### Common Characteristics

<b>Frequency</b>	Resolution	1 $\mu$ Hz
<b>Amplitude</b>	Range	10 mV <sub>pp</sub> to 10 V <sub>pp</sub> into 50 $\Omega$ 20 mV <sub>pp</sub> to 20 V <sub>pp</sub> into open circuit
	Accuracy <sup>1,2</sup> (at 1 kHz)	$\pm 1\%$ of setting $\pm 1$ mV <sub>pp</sub>
	Units	V <sub>pp</sub> , V <sub>rms</sub> , dBm
	Resolution	4 digits
<b>DC Offset</b>	Range (peak AC + DC)	$\pm 5$ V into 50 $\Omega$ $\pm 10$ V into open circuit
	Accuracy <sup>1,2</sup>	$\pm 2\%$ of offset setting $\pm 0.5\%$ of amplitude $\pm 2$ mV
	Resolution	4 digits
<b>Main Output</b>	Impedance	50 $\Omega$ typical
	Isolation	42 Vpk maximum to earth
	Protection	Short-circuit protected, overload automatically disables main output
<b>Internal Frequency Reference</b>	Accuracy <sup>5</sup>	$\pm 10$ ppm in 90 days $\pm 20$ ppm in 1 year
<b>External Frequency Reference (Option 001)</b>	Rear Panel Input	Lock Range 10 MHz $\pm$ 500 Hz
	Level	100 mV <sub>pp</sub> to 5 V <sub>pp</sub>
	Impedance	1 k $\Omega$ typical, AC coupled
	Lock Time	< 2 seconds
	Rear Panel Output	Frequency 10 MHz
	Level	632 mV <sub>pp</sub> (0 dBm), typical
	Impedance	50 $\Omega$ typical, AC coupled
	Phase Offset	Range + 360° to - 360°
	Resolution	0.001°
	Accuracy	20 ns
<b>AM, FM, FSK</b>	Carrier waveforms	Sine, Square, Ramp, Arb
	Source	Internal/External
	Internal modulation	Sine, Square, Ramp, Triangle, Noise, Arb (2 mHz to 20 kHz)
	Depth	0.0% to 120.0%
<b>PM</b>	Carrier waveforms	Sine, Square, Ramp, Arb
	Source	Internal/External
	Internal modulation	Sine, Square, Ramp, Triangle, Noise, Arb (2 mHz to 20 kHz)
	Deviation	0.0 to 360.0 degrees
<b>External Modulation Input<sup>6</sup></b> (for AM, FM, PM, PWM)	Voltage range	$\pm 5$ V full scale
	Input impedance	5 k $\Omega$ typical
	Bandwidth	DC to 20 kHz

#### Modulation

More detailed specifications at [www.agilent.com/find/33220A](http://www.agilent.com/find/33220A)

# Function/Arbitrary Waveform Generator

## 33220A 20 MHz (Continued)

### Specifications

(at 0° to 55°C unless otherwise specified)

#### Connectivity

The Agilent IntuiLink Arbitrary Waveform software allows you to easily create, edit, and download complex waveforms using the waveform editor. Or you can capture a waveform using IntuiLink for Oscilloscope and send it to the 33220A for output. To find out more about IntuiLink, visit [www.agilent.com/find/intuilink](http://www.agilent.com/find/intuilink).

#### Software Driver:

- SCPI
- *VXIPlug&Play*
- IVI.com

#### Ordering Information

##### Agilent 33220A

20 MHz Function/Arbitrary Waveform Generator

#### Accessories included

Operating manual, service manual, quick reference guide, IntuiLink waveform editor software, test data, USB cable, and power cord.

#### Options

- Opt. 001** External frequency reference
- Opt. 0B0** Delete manual
- Opt. 1CM** Rackmount kit (also sold as Agilent 34190A)
- Opt. A6J** ANSI Z540 calibration

#### Other Accessories

- 34131A** Carrying case
- 34161A** Accessory pouch
- 34190A** Rackmount kit

#### Footnotes:

- <sup>1</sup> add 1/10th of output amplitude and offset spec per °C for operation outside the range of 18°C to 28°C
- <sup>2</sup> Autorange enabled
- <sup>3</sup> DC offset set to 0 V
- <sup>4</sup> spurious output at low amplitude is -75 dBm typical
- <sup>5</sup> add 1 ppm/°C average for operation outside the range of 18°C to 28°C
- <sup>6</sup> FSK uses trigger input (1 MHz maximum)
- <sup>7</sup> Sine and square waveforms above 6 MHz are allowed only with an "infinite" burst count

#### Sweep

<b>Waveforms</b>	Sine, Square, Ramp, Arb
<b>Type</b>	Linear or Logarithmic
<b>Direction</b>	Up or Down
<b>Sweep time</b>	1 ms to 500 s
<b>Trigger</b>	Single, External, or Internal
<b>Marker</b>	falling edge of sync signal (programmable frequency)

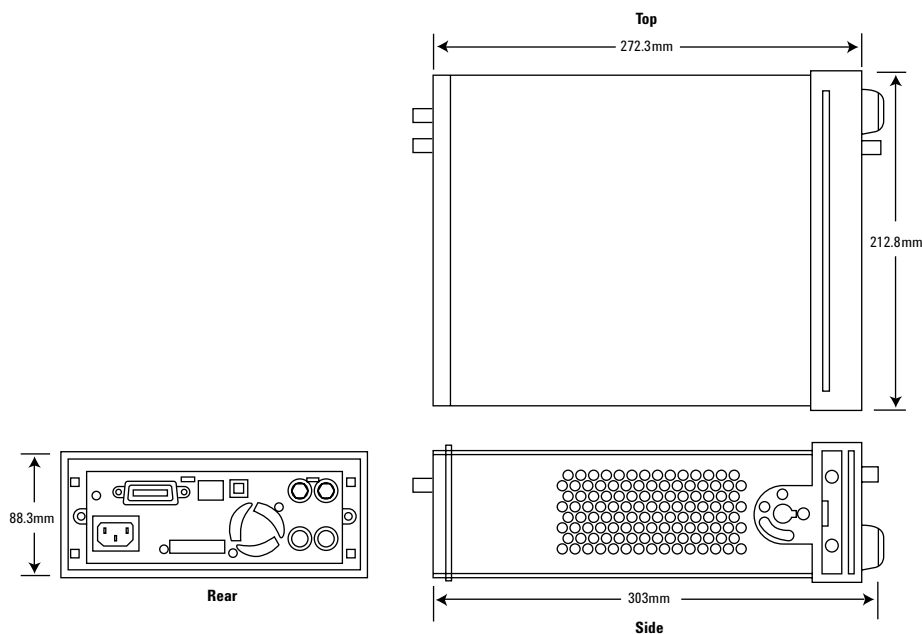
#### Burst<sup>7</sup>

<b>Waveforms</b>	Sine, Square, Ramp, Triangle, Pulse, Noise, Arb
<b>Type</b>	Counted (1 to 50,000 cycles), Infinite, Gated
<b>Start/Stop Phase</b>	-360° to +360°
<b>Internal Period</b>	1 μs to 500 s
<b>Gate Source</b>	External trigger
<b>Trigger source</b>	Single, External or Internal

#### General

<b>Power Supply</b>	CAT II 100 - 240 V @ 50/60 Hz (-5%, +10%) 100 - 120 V @ 400 Hz (±10%)
<b>Power Consumption</b>	50 VA max
<b>Operating Temperature</b>	0°C to 55°C
<b>Interface</b>	USB, GPIB, and LAN standard
<b>Language</b>	SCPI - 1993, IEEE-488.2
<b>Dimensions</b>	(W x H x D)
Bench top	261.1 mm x 103.8 mm x 303.2 mm
Rack mount	212.8 mm x 88.3 mm x 272.3 mm
<b>Weight</b>	3.4 kg (7.5 lbs)
<b>Warranty</b>	1 year

### Agilent Model: 33220A



More detailed specifications at [www.agilent.com/find/33220A](http://www.agilent.com/find/33220A)



33250A

## Function/Arbitrary Waveform Generator 33250A 80 MHz

80 MHz sine and square waveforms  
 Ramp, triangle noise and other waveforms  
 50 MHz pulse waveforms with variable edge time  
 12-bit, 200 MSa/s, 64K-point deep arbitrary waveform  
 AM, FM, PM, FSK linear & logarithmic sweeps and burst

### Specifications

(at 0° to 55°C unless  
otherwise specified)

#### Standard Waveforms

The Agilent Technologies 33250A Function/Arbitrary Waveform Generator uses direct digital-synthesis techniques to create a stable, accurate output on all waveforms, down to 1  $\mu$ Hz frequency resolution. The benefits are apparent in every signal you produce, from the sine wave frequency accuracy to the fast rise/fall times of square waves, to the ramp linearity.

Front-panel operation of the 33250A is straightforward and user friendly. The knob or numeric keypad can be used to adjust frequency, amplitude and offset. You can even enter voltage values directly in Vpp, Vrms, dBm, or high/low levels. Timing parameters can be entered in hertz (Hz) or seconds.

#### Custom Waveform Generation

Why settle for a basic function generator when you can get arbitrary waveforms at no extra cost? With the 33250A, you can generate arbitrary waveforms with 12-bit vertical resolution, 64K memory depth, and a sample rate of 200 MSa/s. You can also store up to four 64K-deep arbitrary waveforms in non-volatile memory with user-defined names to help you find the right waveform when you need it most.

#### Waveforms

Standard	sine, square, pulse, ramp, noise, sin(x)/x, exponential rise, exponential fall, cardiac, DC volts	
Arbitrary	Waveform length	1 to 64K points
	Amplitude resolution	12 bits (including sign)
	Repetition rate	1 $\mu$ Hz to 25 MHz
	Sample rate	200 MSa/s
	Filter bandwidth	50 MHz
	Non-vol. memory	Four (4) 64K waveforms

#### Frequency Characteristics

Sine	1 $\mu$ Hz to 80 MHz
Square	1 $\mu$ Hz to 80 MHz
Pulse	500 $\mu$ Hz to 50 MHz
Arb	1 $\mu$ Hz to 25 MHz
Ramp	1 $\mu$ Hz to 1 MHz
White noise	50 MHz bandwidth
Resolution	1 $\mu$ Hz; except pulse, 5 digits
Accuracy (1 year)	2 ppm, 18°C to 28°C 3 ppm, 0°C to 55°C

#### Sinewave Spectral Purity

Harmonic distortion		$\leq 3 \text{ Vpp}^1$	$> 3 \text{ Vpp}$
	DC to 1 MHz	-60 dBc	-55 dBc
	1 to 5 MHz	-57 dBc	-45 dBc
	5 to 80 MHz	-37 dBc	-30 dBc
Spurious (non-harmonic) <sup>2</sup>			
	DC to 1 MHz	-60 dBc	
	1 to 20 MHz	-50 dBc	
	20 to 80 MHz	-50 dBc + 6 dBc/octave	

#### Signal Characteristics

Squarewave	Rise/Fall time	$< 8 \text{ ns}$
	Overshoot	$< 5\%$
	Asymmetry	1% of period + 1 ns
Pulse	Period	20.00 ns to 2000.0 s
	Pulse width	8.0 ns to 1999.9 s
	Variable edge time	5.00 ns to 1.00 ms

More detailed specifications at [www.agilent.com/find/33250A](http://www.agilent.com/find/33250A)



## Function/Arbitrary Waveform Generator

### 33250A 80 MHz (Continued)

#### Specifications

(at 0° to 55°C unless otherwise specified)

#### Pulse Generation

The 33250A can generate simple pulses up to 50 MHz. With variable edge time, pulse width and voltage level, the 33250A is ideally suited to a wide variety of pulse applications.

#### Built-in Versatility

AM, FM and FSK capabilities make it easy to modulate waveforms with or without a separate source. Linear or logarithmic sweeps can be performed with a programmable frequency marker signal. Programmable burst count and gating allow you to further customize your signal.

#### Color Graphical Display

The unique design of the 33250A combines a low-profile instrument with the benefits of a color graphical display. Now you can display multiple waveform parameters at the same time. The graphical interface also allows you to modify arbitrary waveforms quickly and easily.

#### Timebase Stability and Clock Reference

The 33250A TCXO timebase gives you frequency accuracy of 2 ppm for your most demanding applications. The external clock reference input/output lets you synchronize to an external 10 MHz clock, to another 33250A, or to an Agilent 33220A. Phase adjustments can be made from the front panel or via a computer interface, allowing precise phase calibration and adjustment.

#### Signal Characteristics (Continued)

<b>Ramp</b>	Linearity	< 0.1% of peak output
	Symmetry	0.0% - 100.0%
<b>Arb</b>	Min. edge time	< 10 ns
	Linearity	< 0.1% of peak output
	Settling time	< 50 ns to 0.5% of final value

#### Output Characteristics

<b>Amplitude</b> (into 50 Ω)		10 mVpp to 10 Vpp
	Accuracy (at 1 kHz, >10 mVpp, Autorange)	± 1% of setting ± 1 mVpp
	Flatness (sinewave relative to 1 kHz, Autorange)	<div> <div>&lt; 10 MHz</div> <div>10 to 50 MHz</div> <div>50 to 80 MHz</div> </div> <div> <div>± 1% (0.1 dB)</div> <div>± 2% (0.2 dB)</div> <div>± 5% (0.4 dB)</div> </div>
	Units	Vpp, Vrms, dBm, high and low level
	Resolution	0.1 mV or 4 digits
<b>Offset</b> (into 50 Ω)		± 5 Vpk AC + DC
	Accuracy	1% of setting + 2 mV + 0.5% of amplitude
<b>Waveform Output</b>	Impedance	50 Ω typical (fixed)
		>10 MΩ (output disabled)
	Isolation	42 Vpk maximum to earth
	Protection	short-circuit protected; overload automatically disables main output

#### Modulation

<b>AM, FM</b>	Carrier waveforms	sine, square, ramp, and arb
	Mod. waveforms	sine, square, ramp, noise, and arb
	Mod. frequency	2 mHz to 20 kHz
	Source	internal/external
<b>FSK</b>	Carrier waveforms	sine, square, ramp, and arb
	Mod. waveform	50% duty cycle square
	Internal rate	2 mHz to 1 MHz
	Frequency range	1 μHz to 80 MHz
	Source	internal/external
<b>External Modulation Input</b>	Voltage range	± 5 V full scale
	Input impedance	10 kΩ
	Frequency	DC to 20 kHz

#### Burst

<b>Waveforms</b>	sine, square, ramp, pulse, arb, and noise
<b>Frequency</b>	1 μHz to 80 MHz <sup>3</sup>
<b>Burst count</b>	1 to 1,000,000 cycles or infinite

#### Sweep

<b>Waveforms</b>	sine, square, ramp, and arb
<b>Type</b>	linear and logarithmic
<b>Direction</b>	up or down

More detailed specifications at [www.agilent.com/find/33250A](http://www.agilent.com/find/33250A)

# Function/Arbitrary Waveform Generator

## 33250A 80 MHz (Continued)

### Specifications

(at 0° to 55°C unless otherwise specified)

#### Connectivity

For system applications, both GPIB and RS-232 interfaces are standard, and support full programmability using SCPI commands.

The included Agilent IntuiLink software allows you to easily create, edit, and download complex waveforms using the intuiLink Arbitrary Waveform Editor. Or you can capture a waveform using IntuiLink oscilloscope or DMM and send it to the 33250A for output. For programmers, ActiveX components can be used to control the instrument using SCPI commands. IntuiLink provides the tools to easily create, download, and manage wave-forms for your 33250A.

#### Software Driver:

- SCPI
- *VXIPlug&Play*
- IVI.com

#### Ordering Information

**Agilent 33250A**  
80 MHz Function/Arbitrary  
Waveform Generator

#### Accessories included

Operating manual, service manual, quick reference guide, IntuiLink waveform editor software, test data, RS-232 cable, and power cord.

#### Options

- Opt. 0B0** Delete manual  
**Opt. 1CM** Rackmount kit  
 (also sold as Agilent 34190A)  
**Opt. A6J** ANSI Z540 calibration

#### Other Accessories

- 82357A** Optional USB  
**34131A** Carrying case  
**34161A** Accessory pouch  
**34190A** Rackmount kit\*

\* For racking two 33250As side-by-side, order the following items: Lock-link kit (p/n 5061-9694), Flange kit (p/n 5063-9212)

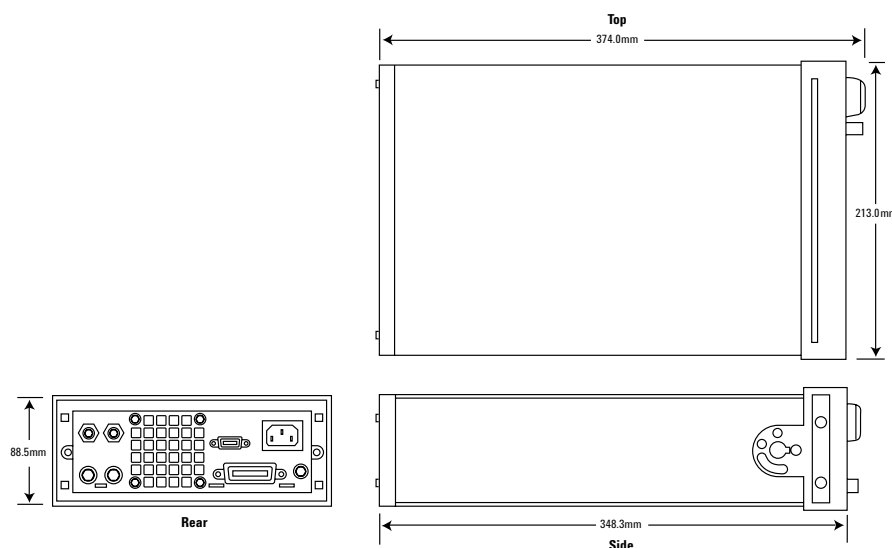
#### System Characteristics

Clock Reference	Phase Offset	Range	-360° to +360°
		Resolution	0.001°
	External Reference Input	Lock range	10 MHz $\pm$ 35 kHz
		Level	100 mVpp to 5 Vpp
		Impedance	1 k $\Omega$ nominal, AC coupled
Internal Reference Output	Lock time	Lock time	< 2 s
		Frequency	10 MHz
		Level	632 mVpp (0 dbm), nominal
		Impedance	50 $\Omega$ nominal, AC coupled
Sync Output	Level	TTL compatible into > 1 k $\Omega$	
	Impedance	50 $\Omega$ nominal	
General	Power supply	100-240 V, 50-60 Hz	
		100-127 V, 50-400 Hz	
	Power consumption	140 VA	
	Operating temp.	0°C to 55°C	
	Stored states	4 named user configurations	
	Interface	IEEE-488 and RS-232 std.	
	Language	SCPI-1997, IEEE-488.2	
	Dimensions	(WxHxD)	
		Bench top	254 x 104 x 374 mm
		Rackmount	213 x 89 x 348 mm
	Weight	4.6 kg	
	Warranty	1 year	

#### Notes:

- <sup>1</sup> Harmonic distortion at low amplitudes is limited by a -70 dBm floor
- <sup>2</sup> Spurious noise at low amplitudes is limited by a -75 dBm floor
- <sup>3</sup> Sine and square waveforms above 25 MHz only with infinite burst count

#### Agilent Model: 33250A



More detailed specifications at [www.agilent.com/find/33250A](http://www.agilent.com/find/33250A)

# VXI Instruments, 3499 Switch Solutions and Connectivity Products

## **Agilent VXI Instruments and Solutions**

Agilent provides more full-featured VXI instrument modules than any other industry-wide open standard architecture. Instruments include C-size and B-size mainframes, multimeters, counters, power meters, digitizers, arbitrary waveform generators, switches, and interfaces. VXI is an ideal solution for systems that require extensive switching with other high-performance instruments - Agilent offers large channel count multiplexers, matrix, and RF switches. You can get complete details including specifics and price at: [www.agilent.com/find/vxi](http://www.agilent.com/find/vxi)

For new system development Agilent offers the 34980A a lower cost solution.

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## **Agilent Hardware and Software for Connectivity**

Agilent offers a complete line of cards and converters for GPIB, USB, RS232, and LAN. Software solutions allow you to quickly connect to any instrument from any vendor, and then combine graphical and textual programming tools to measure, test, and analyze data. Agilent's software applications include VEE Pro, T&M Toolkit, IO Libraries Suite, and IntuiLink. Our software products are part of the Agilent Open family of products featuring open software, system-ready instruments and PC-standard I/O. Agilent Open products give you the freedom to choose the right tools for your test solution and the assurance that they will all work together, every time.

For complete details see [www.agilent.com/find/connectivity](http://www.agilent.com/find/connectivity)

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## **Agilent's 3499 Series Switch Solutions**

Agilent's 3499 Series of switches provide a scalable solution with a choice of three mainframes and over 30 switch modules. Switch signals from DC to light-wave, along with RF, 1000 V, or 8 A of current. All mainframe configurations of the 3499 can scan at rates up to 350 channels per second or open/close 200 channels in less than 0.1 second. Programmable control is provided via either RS-232 or GPIB.

For complete details see [www.agilent.com/find/3499](http://www.agilent.com/find/3499)

For new system development Agilent offers the 34980A a lower cost solution.

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## **34980A A Lower Cost Switch Measure Solution**

The 34980A is an 8-slot mainframe that has an optional built-in DMM and your choice of 19 plug-in modules including switching from DC 20 GHz, digital I/O, D/A converters, and counters. It's ideal for medium to high-density switching and can be more cost effective than the 34970A in some applications. Complete product details for the 34980A can be found at [www.agilent.com/find/34980A](http://www.agilent.com/find/34980A)

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More detailed specifications at [www.agilent.com/find/power](http://www.agilent.com/find/power)

## Agilent Model Number Index

Agilent Model Number	Page Number	Agilent Model Number	Page Number	
33220A	179	6611C	36	
33250A	182	6612C	36	
34401A	158	6613C	36	
34420A	165	6614C	36	
3458A	162	6621A	69	
34970A	143	6622A	69	
34980A	149	6623A	69	
3499A	185	6624A	69	
53131A	169	6625A	71	
53132A	169	6626A	71	
53147A	172	6627A	69	
53148A	172	6628A	71	
53149A	172	6629A	71	
53150A	175	6631B	38	
53151A	175	6632B	38	
53152A	175	6633B	38	
53181A	169	6634B	38	
6010A	25	6641A	40	
6011A	25	6642A	40	
6012B	25	6643A	40	
6015A	25	6644A	40	
6030A	27	6645A	40	
6031A	27	6651A	46	
6032A	27	6652A	46	
6033A	27	6653A	46	
6035A	27	6654A	46	
6038A	27	6655A	46	
6060B	105	6671A	54	
6063B	105	6672A	54	
6541A	43	6673A	54	
6542A	43	6674A	54	
6543A	43	6675A	54	
6544A	43	6680A	65	
6545A	43	6681A	65	
6551A	50	6682A	65	
6552A	50	6683A	65	
6553A	50	6684A	65	
6554A	50	6690A	67	
6555A	50	6691A	67	
6571A	61	6692A	67	
6572A	61	6811B	114	
6573A	61	6812B	114	
6574A	61	6813B	114	
6575A	61	66101A	79	

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## Agilent Model Number Index (Continued)

Agilent Model Number	Page Number	Agilent Model Number	Page Number
66102A	79	N3306A	100
66103A	79	N3307A	100
66104A	79	N5741A	31
66105A	79	N5742A	31
66106A	79	N5743A	31
66309B/D	84	N5744A	31
66311B/D	84	N5745A	31
66319B/D	84	N5746A	31
66321B/D	84	N5747A	32
66332A	84	N5748A	32
E3610A	17	N5749A	32
E3611A	17	N5750A	32
E3612A	17	N5751A	32
E3614A	17	N5752A	32
E3615A	18	N5761A	33
E3616A	18	N5762A	33
E3617A	18	N5763A	33
E3620A	19	N5764A	33
E3630A	19	N5765A	33
E3631A	20	N5766A	33
E3632A	21	N5767A	34
E3633A	21	N5768A	34
E3634A	21	N5769A	34
E3640A	23	N5770A	34
E3641A	23	N5771A	34
E3642A	23	N5772A	34
E3643A	23	N6731B	75
E3644A	23	N6732B	75
E3645A	24	N6733B	75
E3646A	24	N6734B	75
E3647A	24	N6735B	75
E3648A	24	N6736B	75
E3649A	24	N6741B	77
E4350B	91	N6742B	77
E4351B	91	N6743B	77
E4356A	59	N6744B	77
N3280A	94	N6745B	77
N3300A	103	N6746B	77
N3301A	103	N6751A	73
N3302A	100	N6752A	73
N3303A	100	N6761A	73
N3304A	100	N6762A	73
N3305A	100		

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# Agilent Replacement Guide

## Index for Obsolete Agilent System and Bench Products

\* These products are closest in ratings to the discontinued model, but are not identical. Refer to the catalog for the features and specifications of the suggested alternative products.

Obsolete Model Number	Closest Alternatives*	Obsolete Model Number	Closest Alternatives*
6002A	664xA	6268B	6574A
6023A	6033A	6269B	6573A
6024A	6038A	6271B	6544A
6028A	6038A	6274B	6574A
6034A	6038A	6281A	E3614A
6050A	N3300A	6282A	6542A
6051A	N3301A	6284A	E3615A
6200B	E3616A	6286A	6542A
6201B	E3616A	6289A	E3616A
6202B	E3616A	6291A	6543A
6203B	E3614A	6294A	E3617A
6204B	E2617A	6296A	6544A
6205C	(2) E3611A	6299A	6634B or (2) E3617A
6206C	E3617A	6384A	6542A
6211A	E3612A	6427B	6552A
6212C	E3612A	6428B	6011A
6213A	E3610A	6433B	6012B
6214C	E3610A	6434B	6012B
6215A	E3611A	6438B	6544A, 6634B
6216C	E3611A	6439B	6012B
6217A	E3612A	6448B	6015A
6218C	E3612A	6453B	(2) 6572A
6220B	E3617A	6456B	(2) 6572A
6224B	6453A	6459A	(2) 6573A
6226B	6544A	6464C	(2) 6681A
6227B	(2) E3616A	6466C	(2) 6681A
6228B	(2) E3617A	6612B	6612C
6234A	E3620A	6632A	6632B
6235A	E3630A	6633A	6633B
6236B	E3630A	6634A	6634B
6237B	E3611A and E3620A	6814A/B	6813B
6253A	(2) E3615A	6834A/B	6813B
6255A	(2) E3616A	60501B	N3302A
6256B	E6552A	60502B	N3304A
6259B	6572A	60503B	N3303A
6260B	6572A	60504B	N3306A
6261B	6573A	60507B	N3305A
6263B	6542A	66111A	66311B
6264B	6552A	66311A	66311B
6265B	6554A	66312A	66311D or 66319D
6266B	6543A	E4350A	E4350B
6267B	6553A		

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Printed in USA, October 18, 2005  
5988-7834EN



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